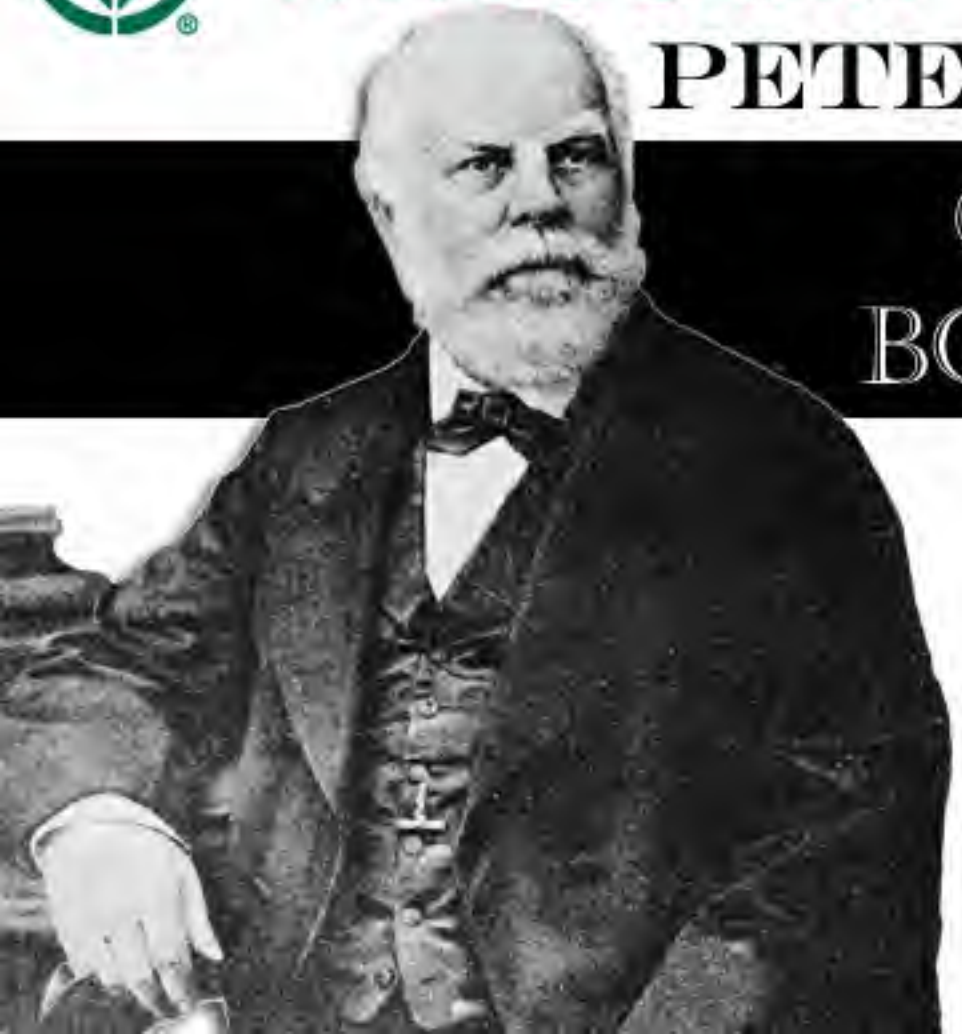
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ENGINEER DEPARTMENT, U. S. ARMY.

EXPLORATIONS ACROSS THE GREAT BASIN OF UTAH IN 1859.

IN CHARGE OF CAPT. J. H. SIMPSON, TOPOGRAPHICAL ENGINEERS.

REPORT

ON THE

BOTANY OF THE EXPEDITION.

BY

Dr. GEORGE ENGELMANN.

WASHINGTON:
GOVERNMENT PRINTING OFFICE
1876.

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Complete

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Botany of Simpson's Expedition.

From Report of Explorations across the Great Basin of Utah in 1859, in charge of Capt. J. H. Simpson. Washington, 1876.

APPENDIX M.

SAINT LOUIS, *December* 31, 1860.

DEAR SIR: Want of time has prevented me fully to elaborate the very rich botanical material brought together, under your orders, by my brother, Henry Engelmann, the geologist and meteorologist of your expedition.

I herewith inclose to you an account of a few species, which seem to have a particular, and principally a practical, interest.

I expect to continue my investigations, and hope to submit them, through you, to the scientific public at a future period.

Very respectfuly, &c.,

GEORGE ENGELMANN.

Capt. J. H. SIMPSON,
Topographical Engineers, U. S. A., Commanding Expedition.

ROSACEÆ.

[435]

CERCOCARPUS LEDIFOLIUS, *Nuttall in Torrey and Gray's Fl. N. Am.* 1, *p.* 427; *and in his continuation of Michaux's Sylva*, 2, *p.* 28, *t.* 51; *Hooker, i. c. pl. t.* 324; *Mountain-Mahogany* of the inhabitants of Utah.

This small evergreen tree is so well described by Nuttall in both works mentioned that not much remains to be added. His figure, however, is not a very faithful representation. He says that it grows much like a peach-tree, at most 15 feet high, and that the trunk is sometimes as much as a foot in diameter. On the expedition, it was found to grow rarely as a tree, but usually branching from the base, or several stems from one root; its height was from 8–15 feet, and the stems seen had the thickness of 3–6, or, at most, 10 inches. The bark is light gray, tough, smoothish, with superficial longitudinal wrinkles and short transverse scars. The wood is hard, heavy, very close-grained, light reddish-brown, with white sap; medullary rays very numerous, but extremely fine, scarcely visible with the naked eye; the wood is similar to cherry-wood, but harder and heavier. A specimen before me has a diameter of 16 lines, 14 lines of which are wood, showing 24 annual rings, so that each ring has a thickness of not much more than $\frac{1}{4}$ line. The shoots, or longer branches, have a white, smooth bark, with joints or internodes of about 1 inch in length. The leaves, however, are usually

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crowded at the end of lateral branchlets, a few lines to 1 or 1½ inches in length closely covered with circular scars. Leaves very thick and leathery, persistent, lanceolate, acute at both ends, entire and revolute at the margin, with a thick midrib, prominent on the lower surface, 9–14 lines long, 2½–3½ lines wide, on a petiole 1½–2 lines long, to the lower part of which adhere lanceolate, brown, scarious stipules. When young, the branchlets as well as the leaves are covered all over with short, curly hair; when older, the leaves become glabrous and glossy on the upper surface, the lower remaining hairy and assuming a rusty color. The sessile flowers are produced in June from the axils of the uppermost leaves of the preceding year's growth, either single or 2 or 3 together; short scarious bracts envelop the base of the cylindrical woolly calyx-tube, which is 3 lines long; its 5-lobed, white limb, 3–4 lines in diameter, is very woolly externally, and less so internally, and bears about 20 or 25 naked, slender filaments, with reniform anthers ½ line in diameter. Immediately after flowering, the silky-feathery style becomes elongated, and carries up with it the detached limb of the calyx; at maturity, the style becomes a twisted, feathery tail of about 2 inches in length; the inconspicuous, linear, hairy fruit itself is about 4 lines long, and remains hid in the persistent, calyx-tube; at its top and base I observe a beard of very curious, stiff, white bristles, less than a line in length, thicker in the middle, and tapering toward both extremities. The fruit seems to be somewhat persistent, as I find it in specimens collected in spring before the flowering-season. About the time of flowering, the young leaves begin to develop at the end of the branchlets, leaving the flowers between them and the leaves of the year before. I generally find 4 or 5 leaves of the same year's growth at the end of each branchlet; they probably fall off when about 15 or 18 months old.

This fine tree, discovered by Nuttall on Bear River, north of the Salt Lake, and near "Thornberg's Ravine" in the Rocky Mountains, was found by the expedition on the Lookout Mountains and other mountain-chains of the basin.*

CACTACEÆ.

The geographical limits of the area of this curious American family have been considerably enlarged by this expedition, proving the presence of at least 7 species in the Utah Basin between the thirty-eighth and fortieth parallels, viz: 2 Echinocacti, 1 Cereus, and 4 Opuntiæ. Several species known before have been found in new localities, and 3 new and very distinct species have been discovered, 2 Echinocacti and 1 Opuntia.

MAMILLARIA VIVIPARA, *Haworth, Suppl. p.* 72; *Torrey & Gray, Fl. N. Am.* 2, *p.* 554; *Engelm. Synops. Cact. p.* 13; Cactus viviparus, *Nuttall, Gen.* 1, *p.* 295,

Was collected in the South Pass and on Sweetwater River. It extends from here to the mountains of Colorado and New Mexico, but its most characteristic forms are peculiar to the more elevated plains, where it assumes that cespitose, spreading appearance, from which it has received its name. The mountain form usually makes larger heads, but remains single or branches out very sparingly. Its large purple flowers, with numerous lance-linear, long acuminate, bristle-pointed petals, and its leather-brown pitted seeds, readily distinguish it from allied species.

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ECHINOCACTUS SIMPSONI (*spec. nov.**): simplex, subglobosus seu depressus, basi turbinatus, mamilliferus; radicibus fasciculatis; tuberculis laxis ovatis apice oblique truncatis axilla nudis, junioribus leviter compressis basi deorsum productis, vetustioribus obcompressis basi dilatatis; areolis ovatis seu ovato-lanceolatis, nascentibus albo-villosissimis mox nudatis; aculeis exterioribus sub 20 radiantibus tenuibus rigidis rectis albidis, additis supra aculeis 2–5 setaceis brevibus, interioribus 8–10 robustioribus obscuris erecto-patulis, areola florifera sub tuberculi apice arcolae aculeigerae contigua circulari; floribus in vertice dissitis minoribus; ovario abbreviato squamis sepaloideis triangulatis paucissimis (1–3) instructo; sepalis tubi brevis late infundibuliformis orbiculatis seu ovatis obtusis membranaceo-marginatis crenulatis fimbriatis, sepalis superioribus 10–12 ovatis obtusis integriusculis, petalis 12–13 oblongis apice crenulatis cuspidatis ex virescente roseis; stigmatibus 5–7 brevibus erectis, bacca parva viridi sicca umbilico latissimo truncata squamis paucis subinde aculeiferis instructa flore marcescente demum deciduo coronata irregulariter basi seu latere dehiscente; seminibus magnis obovatis obliquis minute tuberculatis, hilo magno ovato subbasilari, embryone circa albumen parcum fere circumvoluto hamato.

Var. *β* MINOR: tota planta, tuberculis, aculeis, floribus seminibusque minoribus.

Butte Valley in the Utah Desert, and Kobe Valley farther west; fl. in April and May, fr. in June and July. Var. *β* comes from the mountains of Colorado. This and the New Mexican *Echinocactus papyracanthus*,† the Mexican *Ech. horripilus*, Lem., and perhaps the South American *Ech. Odierii*, Lem., and *Ech. Cummingii*, Salm, and probably one or two others, form the small group of *Echinocacti*, with the appearance of *Mamillaria* (*Theloidei, tuberculis spiraliter dispositis distinctis*, Salm, Cact. Hort. Dyck 1849, cult. p. 34). They constitute the closest and most imperceptible transition to *Mamillaria* subgen. *Coryphantha*, Synops. Cact., p. 8, which bear the flowers in the axils of the nascent tubercules, the flower-bearing and the spine-bearing areolæ being connected by a woolly groove. In *M. macromeris*, Engelmann, they come from the middle of the tubercule (Cact. Mex. Boundary, t. 15, f. 4), and in the *Theloidei* they advance to the top of the tubercule close to the spines, thus assuming the position which the flowers regularly occupy in the genus *Echinocactus* (see Cact. Mex. Bound. t. 20, f. 2; t. 21; t. 25, f. 1; t. 27, f. 1; t. 28, f. 2).‡

The ovary is also almost naked, like that of *Mamillaria* generally, or has only a few scales, like that of *M. macromeris*. On the other hand, the dry fruit, such as is often found in *Echinocactus*, but never in *Mamillaria*, the tuberculated black seeds, and especially the large and curved embryo, and the presence of an albumen, do not permit a separation from *Echinocactus*.

This species is further interesting because it again strikingly proves that the

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* An extract of this description was published in the Transactions of the Saint Louis Academy of Sciences, vol. 2, p. 197 (1863).

† The plant I formerly described as *Mamillaria papyracantha*, Plant. Fendl., p. 49; Synops. Cact., p. 8, proves to belong to this section of *Echinocactus*. A closer examination of Mr. Fendler's original specimen shows that the floral areola joins the spiniferous one at the apex of the small nascent tubercules. Thus far Mr. Fendler's specimen, found near Santa Fé, has remained the only one ever obtained of this pretty species.

‡ *Echinocactus brevihamatus*, Engelm., forms an exception. In this species, the flowers are situated exactly as in *Coryphantha*, at the base of the tubercle, and connected with the distinct spiniferous areola by a woolly groove, (see Cact. Mex. Bound. t. 19, fs. 2 and 3).

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general appearance, the *habitus*, of a cactus plant, not necessarily indicates its real affinities. Not only is it a true *Echinocactus*, notwithstanding every appearance of a *Mamillaria*, but it is, moreover, closely allied in all its essential characters to the very compact *Ech. intertextus*, Engelm., C. Bound. p. 27, t. 34, in which all traces of tubercules are lost in the straight ribs. It has the same small flowers and the same small dry fruit, containing few large seeds, of similar structure, though not entirely the same arrangement of the spines.

Full-grown specimens of our plant are 3–5 inches high and 3–4 inches in diameter, of dark-green color; tubercules loosely arranged in $\frac{8}{21}$ or $\frac{13}{34}$ order, 8 and 13 spirals being most prominent. They are 6–8 lines long, at base somewhat quadrangular, 6–7 lines wide in the vertical and 4–5 lines in the transverse diameter, becoming subcylindric upward; areolæ 3–4 lines long, a little more than half as wide. The fruit-bearing tubercules are rather stouter and shorter. Exterior spines 4–6 lines long, whitish; interior ones spreading, stouter, and a little longer (5–7 lines long), yellowish and upward deep brown or black; no truly central spine. In the very young plant, the spines, 18–20 in number and only 1–1½ lines in length, are all radiating, closely fitting with their compressed bulbous bases on a linear areola, resembling in shape and arrangement those of *Cereus cæspitosus*. Soon afterward the areola becomes wider, and 6 or 8 short, stout, brown interior spines make their appearance, divergent like the original ones. Next the ordinary arrangement, as described above, takes place.

It seems that quite early in spring the young tubercules on the vertex of the plant begin to form, exhibiting their densely woolly tops, and soon afterward, long before any spines make their appearance, the tips of the smooth brown flower-buds come out. The flowers are 8–10 lines long and of nearly the same diameter, externally greenish-purple, petals yellowish-green or verging to pale purple. The short stamens arise from the whole surface of the tube, leaving only a very small nectariferous space in its base. The fruit is about 3 or 3½ lines long and almost as wide, borne on a very large circular areola, surrounded by a woolly margin (see t. 2, f. 1). It bears toward its top 1–3 scales, sometimes with 1 or 2 small spines in their axils. The fruit usually opens by an irregular lateral slit; falling off, its base remains attached to the areola, as is the case in many (or all? or only all the dry-fruited?) *Echinocacti*, thus producing a basal opening (see t. 2, f. 5). Seeds 1½ lines long in the longest diameter, covered with minute close-set tubercles. The young seedling shows erect, pointed cotyledons, and, when a few weeks old, begins to develop its pubescent spines.

Var. *β* has been received this fall from the Colorado gold-region;* the smallest specimens were 1 inch in diameter, globose, the small tubercules in $\frac{8}{21}$ order, spines 1½–2 lines long, often curved; sometimes 1–3 darker stouter ones in the center. The larger specimens are almost of the size of those of Utah, but often depressed at top; tubercules arranged in $\frac{13}{34}$ or even $\frac{21}{54}$ order, spines only 4–5 lines long, 20–28 external and 6 or 7 internal ones.

This species has been named in honor of the gallant commander of the expedition.

* It here grows and thrives probably at a higher elevation than any other northern Cactus, occupying *e. g.* the gravelly moraines of the Glacial period of Clear Creek Valley, between 8,000 and 9,000 feet altitude, and in the southern part of the Territory, the Sangre de Cristo Pass, 10,000 feet high (January, 1876).

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Plate 1. *Echinocactus Simpsoni* as it appears in early spring; on the vertex a young growth of tubercules is visible, their tops covered with wool.

Plate 2. Details of the same.

Fig. 1. Four tubercules from near the vertex, one shows the broad scar where the fruit has fallen off, another one is just developing its spines, exhibiting their points above the thick wool.

Fig. 2. A detached tubercule bearing a ripe fruit.

Figs. 3 and 4. Flowers with the upper part of the tubercule and its young spines.

Figs. 5 and 6. The fruit magnified three times; fig. 5 showing the basal opening, fig. 6 the broad umbilicus.

Fig. 7. A scale of this fruit, more magnified, with two axillary spines.

Figs. 8–12. Seed: fig. 8 natural size, the others eight times magnified; fig. 9 lateral, fig. 10 dorsal, fig. 11 basal view; fig. 12 part of the surface, highly magnified.

Fig. 13. Embryo, enveloped in the inner seed-coat, including also the albumen; magnified.

Fig. 14. Lateral, fig. 15 frontal view of the embryo, magnified.

Fig. 16. Seedling, a few weeks old, magnified.

Fig. 17. Tubercules of the smaller variety from Colorado, in every state of development.

ECHINOCACTUS PUBISPINUS (*spec. nov.*) *: parvulus, turbinatus, costis 13 subobliquis compressis interruptis tuberculatis; areolis orbiculatis, aculeis brevibus, rectis seu sæpe curvatis albidis apice adustis velutinis demum nudatis; radialibus superioribus 1–2 robustioribus, longioribus rectis curvatis seu hamatis, ceteris 5–8 brevioribus; aculeo centrali deficiente seu singulo robustiore longiore arrecto sursum hamato; flore ?; fructu ?.

Pleasant Valley, near the Salt Lake Desert, found May 9 without flower or fruit. Plant 2 inches high, 1 or $1\frac{1}{4}$ in diameter; compressed tubercules 4–6 lines distant from one another, confluent in 13 ribs, radial spines 1–4 lines long, white pubescent or almost tomentose, more so than I have observed it in any other cactus; on the lower areolæ, I find only 5–6 spines, the upper ones a little longer and stouter than the balance; farther upward, the number increases to 10, one or more of the upper ones becoming still stouter and often hooked; at last here and there a single central spine makes its appearance, 5–6 lines long, the strong hook always turned inward or upward. At first, only the dusky point of the spine is naked; with age, the whole coating seems to wear off. In another specimen, I find the spines 8–12 in number, a little longer, more slender, all radiating. The small supraspinal areola proves this plant to be an *Echinocactus;* it probably belongs, together with the next, to the section *Hamati*, Synops. Cact. p. 15.

ECHINOCACTUS WHIPPLEI, *Engelm. & Bigelw, Pacif. R. Rep. IV, Cact. p.* 28, *t.* 1, *Syn. Cact. p.* 15, Var. SPINOSIOR: globosus; costis 13 compressis interruptis; aculeis radialibus 9–11, inferioribus sæpe obscurioribus, reliquis longioribus niveis, 2 superioribus sæpe

* This description has been published in Trans. Acad. St. Louis, vol. 2, p. 199 (1863). It is rather strange that neither this nor the above-mentioned *E. papyracanthus* has ever been found again (January, 1876).

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elongatis complanatis curvatis; centralibus 4, summo elongato complanato pergamentaceo flexuoso albo, 3 reliquis paullo brevioribus obscuris omnibus seu solum infimo hamatis; floribus minoribus; ovario squamis sepaloideis 5 oblongis munito; sepalis tubi linearibus margine membranaceis integris mucronulatis, petalis angustis oblongis; stigmatibus 6–7 brevibus in capitulum globosum congestis; bacca ovata parce squamata floris rudimentis persistentibus coronata.

The species was originally discovered on the Little Colorado by Dr. Bigelow, and was found afterward on the same stream by Dr. Newberry; the variety here described was met with more than 5 degrees farther north, in Desert Valley, west of Camp Floyd; remains of fruit, with the withered flowers attached, and some seeds, were found concealed between the spines from which the description has been drawn.* Globose heads 3 inches in diameter, radial spines $\frac{1}{2}$–$1\frac{1}{2}$ inches long, central ones $1\frac{1}{2}$–2 inches in length; flowers, if I may judge from the withered remains, about 1 inch long; ovary small, bearing about 5 membranaceous scales, the lower triangular, the upper oblong-linear, almost entire, and never cordate or auriculate at base, as they appear in most of the allied species; sepals of tube also narrow, linear, or oblong-linear, 2–5 or 6 lines long, $\frac{1}{2}$–1 line wide, stigmas about $\frac{1}{2}$ line long. Fruit apparently an oval berry, $\frac{1}{2}$ inch long; seed just as it is described and figured in Whipple's Cactaceæ; the tubercules on the seed-coat are extremely minute and distant from one another, each forming a central protuberance on the otherwise flat surface of an angular cell of two or three times the diameter of the tubercule itself; embryo curved about $\frac{3}{4}$ around a rather copious albumen.

CEREUS VIRIDIFLORUS, *Engelm. in Wisliz. Mem. note* 8, *sub Echinocereo; Cact. Mex. Bound. t.* 36; *Synops. Cact. p.* 22.

This is evidently the northernmost *Cereus*, extending to the Upper Platte; it is abundant in Colorado. These northern specimens are 1–3 inches high, 13-ribbed, and show the greatest variability in the color of the radial spines; in some bunches, they are all red, in others white, in others again the colors are distributed without much regularity; sometimes the upper and lower spines are white and the lateral ones red, or a few or even a single one above and below are red and all the rest white; or the lower ones are red and the upper ones white, and all these variations sometimes occur on the same specimen. I mention this to show how little reliance can be placed on the colors or the distribution of the colors of the spines. Central spines wanting or 1 or 2 projecting horizontally, straight or curved upward, white or tipped with purple or all purple, 6–9 lines in length.

CEREUS ENGELMANNI, *Parry in Sillim. Journ. n. ser.* 14, *p.* 338; *Engelm. Cact. Bound, p.* 36, *t.* 57; *Synops. Cact. p.* 27.

Deserts west of the Salt Lake, without flower or fruit. Specimen entirely similar to the one figured in the Cactaceæ of the Boundary. The species seems to extend from the Salt Lake region southwestwardly to Arizona and the Mohave country.

* The botanist of Dr. Hayden's Expedition of 1875, Mr. Brandegee, found it abundantly in Southwestern Colorado (January, 1876).

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OPUNTIA SPHÆROCARPA, *Engelm. and Bigelow, Pac. R. Rep. IV, Cact. p.* 47, *t.* 13, *fs.* 6–7; *Syn. Cact. p.* 44, Var.? UTAHENSIS: diffusa, læte-virens, articulis orbiculato-obovatis, crassis, junioribus sæpe globoso-obovatis; areolis subapproximatis; foliis minutis subulatis divaricatis; setis brevissimis paucis stramineis; aculeis nullis seu parvulis nunc singulo longiore recto robusto albido; floribus sulphureis, ovario obovato areolis fusco-tomentosis sub-25 instructo, sepalis exterioribus transversis obcordatis cuspidatis; petalis 8 late-obovatis emarginatis; stylo vix supra stamina exserto; stigmatibus 8 brevibus erectis; bacca obovata areolis plurimis tomentosis stipata; seminibus numerosis irregulariter compressis anguste marginatis.

Pass west of Steptoe Valley, in the western mountains of the Basin, found July 19 in flower and fruit. Joints 2–3 inches long and of almost the same diameter; often over $\frac{1}{2}$ inch in thickness, sometimes almost terete or rather egg-shaped; areolæ 6 or 8 lines apart; leaves very slender and acute, scarcely 1 line long, smaller than in any other of our species except *O. basilaris*, also a western form from the Lower Colorado. Bristles few, and even in old joints scarcely more than $\frac{1}{2}$ line long; spines none, or on the upper areolæ a few short ones, with here and there a stouter one $\frac{3}{4}$–1 inch in length. Flowers nearly 3 inches in diameter, pale or sulphur-yellow, when fading, reddish; fruit about 1 inch long and half as wide, with a deep umbilicus, and with 20–25 areolæ, which sometimes show a few bristles or a minute spine; seeds very irregular, 2, or, in the largest diameter, sometimes $2\frac{1}{2}$ lines wide.

Unwilling to increase the number of ill-defined species in this most difficult genus, I attach this plant to the only species known to me to which it possibly can be compared, *O. sphærocarpa* from New Mexico, though its fruit is not spherical, has not a shallow umbilicus, and is, at least in the specimen before me, not dry; the latter would be an insuperable distinction, if we might not suspect, what in fact is often the case, that the fruit later in the season would become dry and brittle. The leaves, which heretofore have been entirely too much neglected as a diagnostic character in this genus, and the flowers of the original *O. sphærocarpa*, are unknown thus far.

OPUNTIA TORTISPINA, *Engelm. & Bigelow, l. c. p.* 41, *t.* 8. *fs.* 2–3; *Syn. Cact. p.* 37.

Forks of the Platte; in flower in July. The specimens being very incomplete, I am not quite sure that this is the same species as that of Captain Whipple's Expedition; the joints appear to be somewhat smaller, the areolæ closer together, and the spines shorter (1–$1\frac{1}{2}$ inches) and rather weaker; it may possibly prove to be an extreme form of *O. Rafinesquii*, the area of which extends to the Rocky Mountains. Leaves subulate, 2 lines long; flowers $2\frac{1}{3}$–3 inches in diameter, sulphur-yellow; ovary long (1–$1\frac{1}{2}$ inches), with 20–30 areolæ, with light-brown wool and short bright-brown bristles; exterior sepals obovate, lance-cuspidate; petals 6–8, broadly obovate, obtuse, crenulate; stigmas 6–8, short, erect, as long as the stamens.

OPUNTIA HYSTRICINA, *Engelm. & Bigelow, l. c. p.* 44, *t.* 15, *fs.* 5–7; *Syn. Cact. p.* 43.

A flowering specimen, collected in June between Walker and Carson Rivers, is exactly like one found by Dr. Bigelow on the Colorado Chiquito; it has slenderer and straighter spines than the one figured in Whipple's Report, and approaches somewhat to *O. erinacea*, E. & B., of the Mohave region, in which I now recognize the long-los:

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O. rutila, Nutt. in Torr. & Gray Flor. 1, p. 555. Joints 5 inches long, half as wide, obovate; leaves 1½ lines long; areolæ closely set with long straw-colored bristles; lower ones with few and short white spines, upper ones with numerous grayish-red spines, 1½–2 inches in length. Flowers pale straw-colored, 2½–3 in diameter; ovary 1 inch long, with 20–30 white woolly aculeolate areolæ; exterior sepals oblanceolate, squarrose, or recurved at the elongated tip; petals obovate, obtuse, crenulate; style with 8 or 10 short erect stigmas, longer than the stamens. The squarrose tips of the sepals are particularly conspicuous on the bud.

OPUNTIA MISSOURIENSIS, *De Cand. Prod.* 3, *p.* 472; *Torr. & Gray, Fl.* 1, *p.* 555 (*in part*); Cactus ferox, *Nutt. Gen.* 1, *p.* 296.

From the deserts of Salt Lake Valley to Rush Valley; specimens without flower or fruit. Joints small (2–3 inches long), broadly obovate or circular; areolæ closely set; spines numerous, stiff, stout, angular, white, mostly deflexed.

OPUNTIA MISSOURIENSIS, var. ALBISPINA, *Engelm. & Bigelow, l. c. p.* 46; *t.* 14, *fs.* 8–10; *Syn. Cact. p.* 44.

Smith Creek, Lookout Mountains, in Western Utah; flowering in July. By their slender flexuous spines, the specimens approach to var. *trichophora.* Flowers 3–3½ inches in diameter, bright golden-yellow; ovary 1 inch long, with 20 or 25 areolæ, scarcely spiny; exterior sepals obovate, cuspidate; petals about 8, obtuse, crenulate; style shorter than the stamens; stigmas about 5, very short, erect. Some flowers have elongated and very spiny ovaries, evidently abortive.

OPUNTIA FRAGILIS, *Haworth, Suppl. p.* 82; *Torr. & Gray, Fl.* 1, *p.* 555; *Synops. Cact. p.* 45; Cactus fragilis, *Nutt. Gen.* 1, *p.* 296.

Fort Kearny to the North Platte country; in flower in June and July. This is, I believe, the first time that the flowers of this species were collected since Nuttall's discovery of it in 1813. Travelers report that the plant is very frequently seen in the sterile prairies east of the Rocky Mountains, but that it is rare to find them in flower and rarer still in fruit. Since many years I have the plant in cultivation from specimens brought down by Dr. Hayden, but have not been able to get it to flower. Nuttall only informs us that the flowers are solitary and small. In the specimen before me, they are yellow, scarcely 2 inches in diameter; ovary 8–9 lines long; the 13–15 areolæ are densely covered with thick white wool; the upper ones bear a few white spines; lower sepals broadly oval, with a short cusp; petals 5, obovate, rounded, crenulate; style longer than the stamens; stigmas 5, short, erect, cuspidate.*

* Through the kindness of Dr. A. W. Chapman, of Apalachicola, Fla., I have received living specimens of *O. Pes Corvi*, so that I can now complete the description of this very distinct southern species.

OPUNTIA PES CORVI, *Le Conte in herb. Engelm.*; *Append. to Synops. Cact. in Proceed. Am. Acad. Arts & Sc.* 3, *p.* 3[illegible] *man, Fl. South. U. S. p.* 145: diffusa, læte viridis; articulis parvis ovatis seu obovatis tumidis sæpius teretius[illegible] catenatis fragilibus; pulvillis subdistantibus pulvinatis; foliis teretiusculis ovatis cuspidatis incurvis; areolis j[illegible] albo-tomentosis setas parcas brevissimas pallidas et plerisque aculeos 1–3 rectos rigidos sæpe basi compressos obscuros gerentibus, infimis inermibus; floribus flavis minoribus; ovario obovato pulvillos perpaucos fusco-vi[illegible] rente; sepalis exterioribus ovato-lanceolatis, interioribus obovatis cuspidatis; petalis sub-5 obovatis spatulatis stylo stamina æquante, stigmatibus 4–5 erectis; seminibus paucissimis anguste obtuseque marginatis in pulp[illegible] baccæ parvæ rubræ sæpe floris rudimentis coronatæ nidulantibus.

Barren sandy places along the coast of Georgia and Florida. Joints 1–3 inches long, obovate tumid, or

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crenulate; style longer than the stamens; stigmas 5, short, erect, cuspidate.*

* This note, containing the character and description of Opuntia pes-corvi, having been printed in the preceding article (p. 226), is here omitted. — Editors.

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l Florida. Joints 1–3 inches long, obov



OPUNTIA PULCHELLA (*spec. nov.*):* parvula cæspitosa diffusa; articulis parvis obovato-clavatis; foliis minutis e basi ovata subulatis; areolis confertis, superioribus aculeos albidos rectos, singulum longiorem complanatum porrectum seu deflexum alios brevissimos radiantes gerentibus; floris purpurei ovario areolis 13–15 convexis albo villosissimis et longe setosis dense stipato; sepalis inferioribus lineari-oblongis breviter cuspidatis, superioribus spatulatis; petalis sub-8 obovatis obtusis, stylo cylindrico exserto, stigmatibus 5 linearibus suberectis; bacca sicca setosissima, seminibus crassis rhaphe lata plana notatis.

Sandy deserts on Walker River;† fl. in June.

This is one of the smallest, as it is one of the prettiest, species of this genus. It belongs to the small section of *Clavatæ* (Synops. Cact. p. 46) of the cylindric *Opuntiæ*, but is distinct from all those known to me by its small joints and purple flowers; all the others have, so far as I know, yellow flowers. Joints 1–1¼ inches long, 4–6 lines thick, very slightly tuberculated; leaves scarcely one line long; areolæ crowded, white woolly; larger central spine on the upper areolæ 4–6 lines long, flat, and somewhat rough above, convex below; smaller ones 4–6 or 10, radiating, ½–1½ lines long; flowers crowded, of a beautiful bright purplish-red or deep rose-red color, 1¼–1½ inches in diameter; ovary 4–5 lines long, beset with white capillary spines, 3–5 lines long, 15–20 on each areola; style not ventricose, as is usual in the genus, but cylindric; stigmas slender, pale yellow; berry clavate, at last dry, about 1 inch long, well marked by the conspicuous white-woolly areolæ and their numerous purplish-brown, flexible, hair-like bristles, 4–6 or 7 lines long. These bristles are entirely destitute of the minute barbs which otherwise invariably characterize spines and bristles of *Opuntiæ*. The thick round seeds, 2 lines in diameter, are well distinguished by a broad rhaphe, much wider than I have seen it in any other clavate *Opuntia*.

Plate 3, Fig. 1. Part of a plant of *Opuntia pulchella*, showing a flower-bud and two flowers, natural size.

Figs. 2–4. Bunches of spines, 4 times the natural size.

Fig. 5. Section of a larger spine, more magnified.

Fig. 6. A leaf from an ovary with the axillary woolly and bristly areola, 4 times natural size.

Fig. 7. A fruit.

Figs. 8–9. Seed, 4 times magnified; fig. 9 showing the broad rhaphe.

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and cylindric, fresh or dark green, usually growing one on top of the other, forming chains of 1 or 2 feet long, at last prostrate; joints fragile, separating as readily as in *O. fragilis;* tumid pulvilli 4–6 or even 8 lines apart; leaves 2½–3½ or 4 lines long, incurved; spines 1–1½ inches long, very straight, when in threes divergent like the "crowsfoot" used against cavalry, whence the name given by the military gentlemen who discovered this species. Flowers 1½–1¾ inches in diameter; sepals and petals less numerous and narrower than in any allied species; ovary about ½ inch long, with only 2 or 3 areolæ on the surface and 3–5 on the upper margin. Fruit obovate, 6–7 lines long, rose-purple, with a shallow umbilicus, oftened crowned with the blackened remains of the flower; areolæ almost obliterated; red pulp very glutinous, including 1–3 or at most 5 seeds, which are regularly shaped, lenticular, with a narrow but thick and very obtuse rim. By its pulpy fruit, this species is widely removed from *O. fragilis*, to which its tumid and fragile joints seem to ally it, nor can it be confounded with any other species, though allied to *O. vulgaris* and *O. Rafinesquii*.

* An account of this species was given in the Transactions of the St. Louis Acad. 2, p. 201 (1863).

† This pretty species was afterward collected, 1867, "among the sage brushes" of Nevada, by Mr. William Gabb and in the following year by Mr. S. Watson "frequent in the valleys of Western Nevada from the Trinity Mountains to Monitor Valley, 4–5,000 feet alt."

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COMPOSITÆ.

The name of "*Wild Sage*", now so familiar to every traveller in our western mountain-deserts, was first used by Lewis and Clarke, in the narrative of their adventurous expedition, to designate several species of *Artemisia* or *Wormwood*, distantly resembling the true garden sage, *Salvia officinalis*, by their gray foliage and aromatic odor. It seems that now this name has, by common use, been restricted to the larger shrubby species, which give a peculiar character to the arid plateaus of Western North America, and which are of the highest importance to the traveller as "furnishing the sole article of fuel or shelter which they meet in wandering over these woodless deserts", as already Nuttall informs us in his genera of North American Plants, 2, p. 142. He states that the "Wild Sage" is his *Artemisia Columbiensis*, which name was by him improperly substituted for the prior name of *A. cana*, described by Pursh from the original specimens of Lewis and Clarke. Torrey and Gray, in their Flora of N. America, 2, p. 418, doubt whether this really is the "Wild Sage" of those travelers, and come to the conclusion that that name was indiscriminately applied to several shrubby species; they further state that the plant given by Governor Lewis to Pursh as "the Sage" is the herbaceous *A. Ludoviciana* found on the homeward voyage on the Missouri River.

I have now the means, through information obtained from Mr. H. Engelmann and from Dr. F. V. Hayden, to throw a little more light on this question, which is not without importance for botanical geography. The two species here in question are—

ARTEMISIA CANA, *Pursh, Fl. Am. sept.* 2, *p.* 521; *Torrey and Gray, Fl. N. Am.* 2, *p.* 418.—Shrubby, with woody stem 2–4 inches in diameter, 2–4 feet (on the Yellowstone, Dr. Hayden) or 2–6 feet high (on the Laramie Plains, H. Engelmann). Stem covered with a light-gray bark, which is separated into many layers of loose shreds connected by smaller transverse fibers, and is readily torn off. Wood light, porous, pale-colored, with very many darker brown medullary rays, easily separating along the division of the annual rings. These rings, or layers, are from $\frac{1}{2}$–1 line in thickness, as stems of $1\frac{1}{2}$–2 inches diameter show about a dozen rings, and are consequently as many years old. The stems are rarely cylindrical, but mostly compressed, knotty, and variously twisted, and often stunted; they are sometimes divided from the base, but oftener bear short and thick branches higher up. The annual branchlets are crowded along the older branches, 8–12 inches long, densely coated with a soft, white pubescence, and crowded with silvery-gray leaves, and bear toward their upper part and on the numerous short and erect lateral branchlets a profusion of small flower-heads, forming a spiked or contracted panicle, interspersed with short leaves. The leaves are flat, linear-lanceolate, entire or (the lower ones) rarely lobed, 1–2 or $2\frac{1}{2}$ lines wide and $1\frac{1}{2}$–2 inches long, the upper ones becoming smaller. The flower-heads are mostly sessile, or nearly so, hemispherical, about 2 lines long and wide; outer scales of involucrum shorter, foliaceous, and canescent (sometimes the lowest ones larger than the flowers, and pointed); inner scales nearly as long as flowers, brownish, scarious, obtuse, cottony-fimbriate on the margins. The flowers are all perfect, usually 5, in some specimens as many as 8 in number, $1\frac{1}{2}$ lines long; ovary glandular, and, when bruised, with the odor of wormwood.

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This is the "Wild Sage" of the Upper Missouri (above the mouth of the Yellowstone) and the Yellowstone River, and of the Laramie Plains, but it does not seem to occur west of the Rocky Mountains, as Torrey and Gray (*l. c.*) already state, and Nuttall (*l. c.*) must have confounded it with other species, when he contends that it is "still more abundant on the barren plains of the Columbia River", and that it grows 6 to 8 or 12 feet high.

ARTEMISIA TRIDENTATA, *Nuttall in Trans. Amer. Phil. Soc.* (*n. ser.*) 7, *p.* 398; *Torrey and Gray, Fl.* 2, *p.* 418.—Trunk, bark, and wood very similar to that of the last species, but trunk often larger, and usually even more twisted and knotty, with very numerous short and stunted branches, which are repeatedly divided into a great many smaller branchlets; ultimate annual branchlets fascicled, erect, only 3–6 inches long, canescent or silvery, very leafy at base, rather naked upward, bearing strict, rather compact, paniculate spikes, composed of sessile or usually pedunculate spikelets or glomerules of 3 to 6 or 8 sessile heads. Leaves silvery-white on both surfaces, crowded at the base of the branches, and often fascicled on short or stunted sterile branches, narrowly wedge-shaped, 1½–2 lines wide at the obtuse tridentate or trilobed end, narrowed down into a more or less distinct petiole; usually 3–6, rarely 8, lines long. Inflorescence interspersed with short and narrow, undivided, cuneate or spatulate obtuse leaves. Heads of flowers narrow, obovoid, nearly 1½ lines long, not much more than half as wide, with short and obtuse, canescent, exterior scales, and longer, scarious, interior scales, ciliate on the sides. Flowers in some specimens 3, in others often 4–5 in each head, all perfect, scarcely more than 1 line long; ovary quite glandular and with the odor of turpentine.

This is the "Wild Sage" of Utah, and, perhaps, of the whole region west of the Rocky Mountains, where it seems to supplant the more eastern *A. cana*. Nuttall, who first described it, calls it a shrub about a foot high, and as such it appears in the mountains of Colorado; but in Utah it is the largest and most abundant species, usually 2–4 feet high, rarely attaining a height of 6 feet, and then not straight, and with trunks of 3–6 inches diameter; sometimes the smallest bushes have trunks fully as thick as the tallest ones, short and chunky. East of the mountains, in the range of *A. cana*, it ever remains an inconspicuous shrub, lost among the more common species. Near Camp Floyd, specimens were collected bearing white tomentose excrescences of the size of a pea, or larger, undoubtedly galls caused by the sting of insects; the same have been observed on this species in Colorado.

The other species of *Artemisia* collected by the expedition were *A. Canadensis*, Michx., at Bridger's Pass; *A. Ludoviciana*, Nutt., at Sweetwater, Bridger's Pass, Round Prairie, etc.; *A. dracunculoides*, Pursh, on the Sweetwater; and *A. frigida*, Willd., on the Upper Sweetwater River.

CHENOPODIACEÆ.

SARCOBATUS VERMICULATUS, *Torrey in Emory's Report* (1848), *p.* 149. Batis (?) vermiculata, *Hooker, Flor. Bor.-Am.* 2, *p.* 128 (1840); Sarcobatus Maximiliani, *Nees in Pr. Maximil. Trav. Engl. ed. p.* 518 (*ex Torrey*), *Seubert in Bot. Zeitung*, 1844, *p.* 753, *cum tab.*, *Lindley in Hooker, Lond. Journ. Bot. IV*, *p.* 1 (1845); Fremontia vermicularis,

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Torrey in Frémont's First Report, 1843, *Rept.* 1845, *p.* 95, *and Frémont's Second Report*, 1845, *p.* 317, *tab.* 3; Sarcacanthus, *Nuttall in Pl. Gambel, p.* 184; Sarcobatus vermicularis, *Torrey in Sitgr. Rep. p.* 169, *in Stansb. Rep. p.* 394, *in Bot. Whipple, p.* 130;* *Pulpy Thorn* or *Pulpy-leaved Thorn* of Lewis and Clarke; *Greasewood* of the present travelers and settlers.

This curious and important plant is found on the arid saline plains, principally on clayey soil, which in the wet season is moist, and on the border of salt-lakes, often covering large patches, from below Fort Pierre on the Missouri (*Dr. Hayden*) to the Upper Platte River (*Frémont, H. Engelmann*), and Upper Canadian (*Dr. James*) east of the Rocky Mountains to the plains of the Columbia (*Lewis and Clarke, Douglas, Frémont*), Utah (*Frémont, Stansbury*) through the Basin to Carson Valley (*H. Engelmann*) and down to the Gila River (*Emory*). Though discovered and noticed by Lewis and Clarke (1804) and collected by Dr. James (1819), this shrub was first described, 1840, by Hooker, in his North American Flora, from Oregon specimens, and was doubtfully referred by him to *Batis.* A few years later, it was again described by Nees in his account of the plants collected by the Prince of Neu Wied as a new genus under the name of *Sarcobatus*, and very soon afterward, and without a knowledge of the publication by Nees, again by Torrey under that of *Fremontia.* It is a great pity that this last name had to give way to priority, though at present a much handsomer and showy Californian shrub bears Frémont's name, the wide-spread *Greasewood* of the western mountains and deserts would more fitly have commemorated the bold and hardy pioneer of explorers to the millions, who now do or in time to come will know and value this plant.

The *Greasewood* forms a scraggy, stunted shrub, 2 or 3 to as much as 6 or 8 feet high; in Utah, it is commonly 3–4 feet high. The stems are scarcely ever more than 1 or 2 and rarely 3 inches thick, knotty, flattened, twisted, and often with irregular ridges and holes (the scars of decayed branches); sometimes, however, many straight shoots issue from a single base, $\frac{1}{4}$–$\frac{1}{2}$ inch thick, so straight as to be used for arrows. They are covered with a compact, smoothish or slightly roughened, light-gray bark. The wood is very hard and compact, of light-yellow, in the core light-brownish, color, with very thin annual layers, in younger plants about $\frac{1}{3}$, in older ones $\frac{1}{4}$ of a line or less thick. The oldest stems seen showed 20–25 rather indistinct rings, and were consequently so many years old. The numerous smaller branches have a smooth, shining, white bark, and are beset with white spines at right angles; these spines are indurated branches of two kinds. The sharper and shorter ones are real spines, scarcely ever more than $\frac{1}{2}$–1 inch long; they bear leaves only, or, in the axils of these, female flowers, and are terminated by a sharp point and never by a staminate spike. The other spines are branchlets which did bear such a terminal spike, which, after flowering, has fallen away; they are 1–2 inches long, sometimes even longer, when they are apt to bear also lateral spines. The flower-bearing branches are very often secondary axillary productions closely under the sterile primary branch, which constitutes the spine, so that the spines often appear as axillary to the flower-bearing branches. The leaves are thick and pulpy, linear, or often narrowed toward the base, flattened or even slightly

* Compare S. Watson's Revision of the American Chenopodiaceæ in Proc. Am. Ac. Arts Sc. vol. 9, p. 82 (1875).

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channeled on the upper surface, and keeled on the lower one, at least toward the base, leaving a triangular scar after falling off. They are $\frac{1}{2}$–1 inch, rarely as much as $1\frac{1}{2}$ inches long, and $\frac{1}{2}$ line, or sometimes, in the upper half, even 1 line, wide; in young and vigorous shoots, I have seen the leaves flatter, shorter, and broader, almost lanceolate. Their surface usually is perfectly glabrous; in specimens from Carson Lake, however, I find the younger leaves covered with a rough and sometimes branched pubescence. The leaves are sometimes on the lower part of the branches opposite, but commonly alternating in $\frac{2}{5}$ order. The staminate and pistillate flowers are both very imperfect, but very different in their arrangement and structure; they usually occur on the same plant, though some plants seem to bear scarcely any but staminate, others only pistillate, flowers. The staminate flowers are crowded into a deciduous spike or ament, terminating the branches. This spike is, before the flowers open, 3–5 lines long and $1\frac{1}{2}$ lines thick, and very compact, exhibiting only the rhombic surfaces of the scales; afterward it elongates to the length of 5–9 lines, showing the deciduous anthers under and between the separated scales. The spike consists of 25–35 peltate angular scales, pointed at the upper end, which cover 3–5 broadly oval anthers, sessile on the rhachis, $\frac{1}{2}$ line long, 2–celled, opening laterally. The fertile flowers are usually solitary in the axils of the leaves and sessile; in some specimens, I find a secondary flower just below the primary one, and sometimes even below a branch, springing from the same axil; sometimes they are aggregated on abbreviated branchlets, forming irregular clusters. The flower consists of a tubular calyx with an inconspicuous rim, investing the lower half of the ovary, which is terminated by two unequal subulate stigmas, lateral in regard to the stem. In the fruit, this rim is enlarged to a broad, circular, spreading wing, 3–5 lines in diameter, green or sometimes red, which surrounds the upper third of the fruit. The flattened vertical seed, inclosed in the membranaceous utriculus, is about 1 line in diameter, and contains a spiral embryo without an albumen, as already demonstrated and figured by Professor Torrey in Frémont's Report.

The Greasewood is found in flower from June to August.

The form from Carson Lake seems to be distinguished not only by the pubescence of the younger parts of the plant, but also by its more squarrose growth, its subdiœcious flowers, and its aggregated fertile flowers and fruits; but the Greasewood of other localities is also often subdiœcious, so that when first described, it was considered a truly diœcious plant.

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APPENDIX M.

REPORT

ON THE

BOTANY OF THE EXPEDITION.

BY

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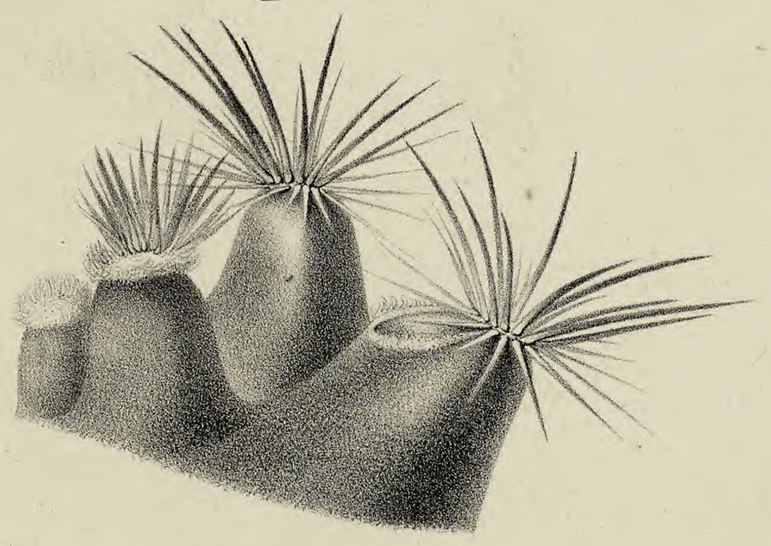
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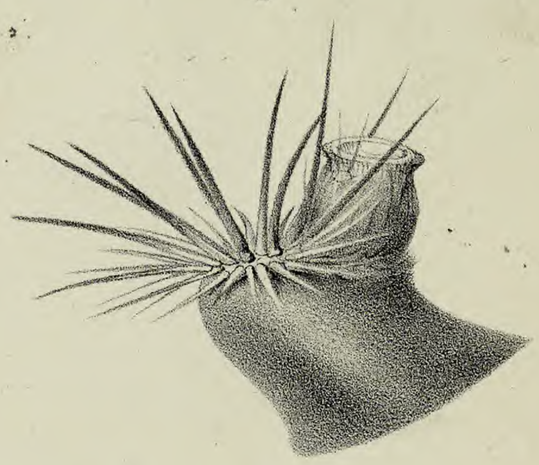
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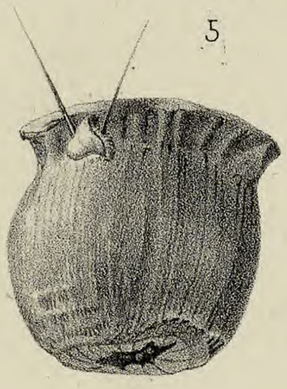
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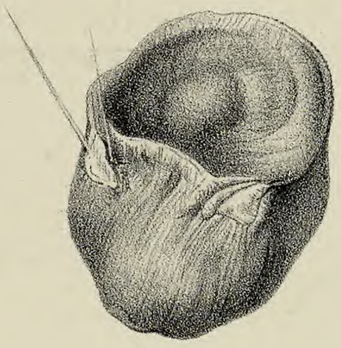
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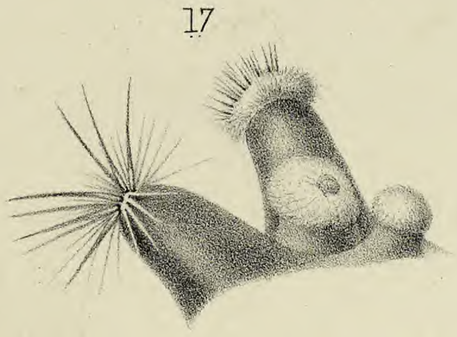
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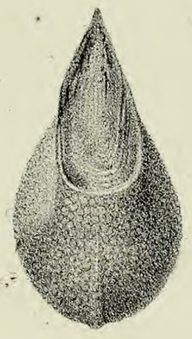
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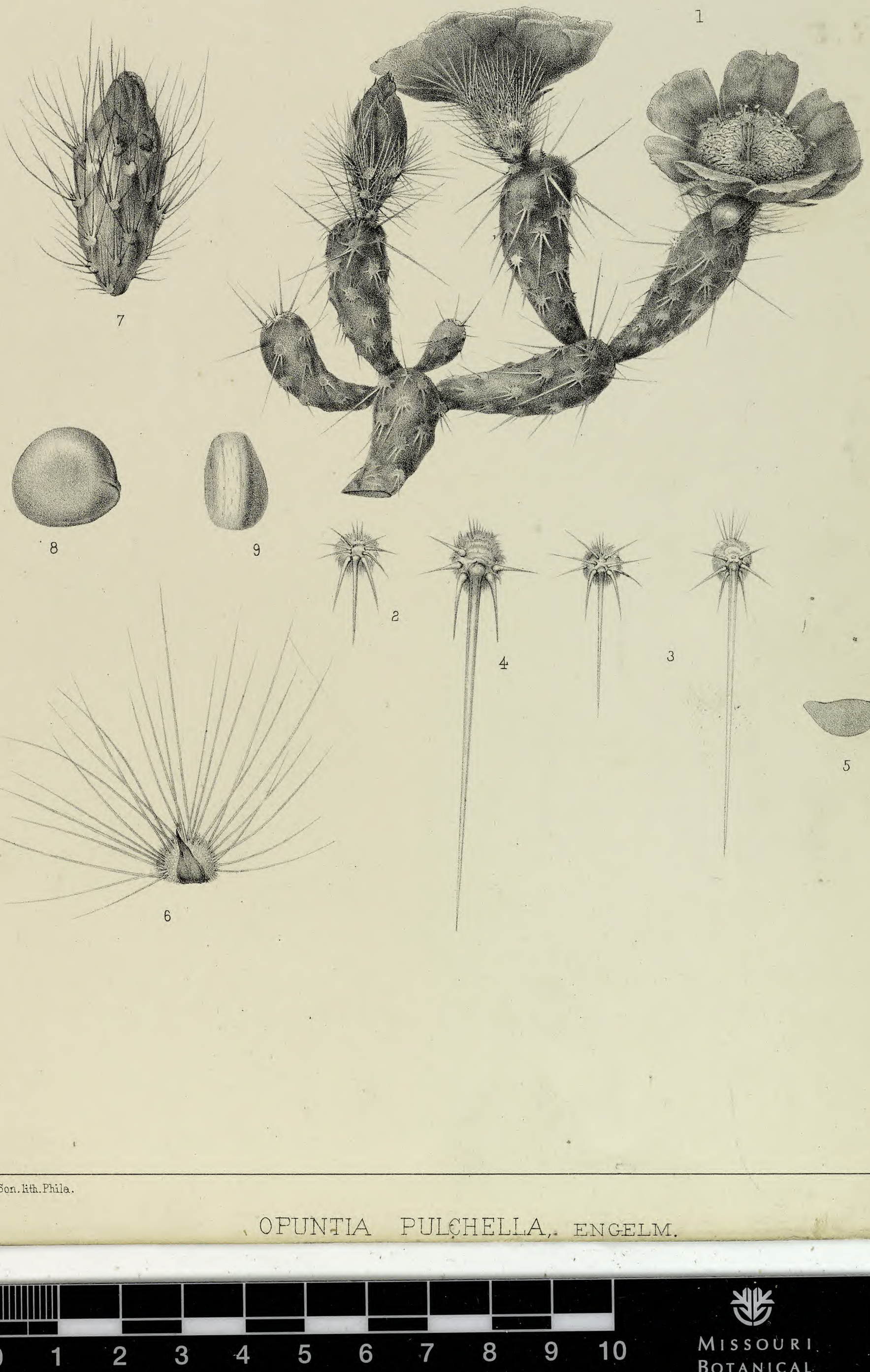
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OPUNTIA PULCHELLA, ENGELM.

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ENGINEER DEPARTMENT, U. S. ARMY.

EXPLORATIONS ACROSS THE GREAT BASIN OF UTAH IN 1859.

IN CHARGE OF CAPT. J. H. SIMPSON, TOPOGRAPHICAL ENGINEERS.

REPORT

ON THE

BOTANY OF THE EXPEDITION.

BY

Dr. GEORGE ENGELMANN.

WASHINGTON:
GOVERNMENT PRINTING OFFICE
1876.

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APPENDIX M

REPORT

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APPENDIX M.

SAINT LOUIS, *December* 31, 1860.

DEAR SIR: Want of time has prevented me fully to elaborate the very rich botanical material brought together, under your orders, by my brother, Henry Engelmann, the geologist and meteorologist of your expedition.

I herewith inclose to you an account of a few species, which seem to have a particular, and principally a practical, interest.

I expect to continue my investigations, and hope to submit them, through you, to the scientific public at a future period.

Very respectfuly, &c.,

GEORGE ENGELMANN.

Capt. J. H. SIMPSON,
Topographical Engineers, U. S. A., Commanding Expedition.

ROSACEÆ.

CERCOCARPUS LEDIFOLIUS, *Nuttall in Torrey and Gray's Fl. N. Am.* 1, *p.* 427; *and in his continuation of Michaux's Sylva*, 2, *p.* 28, *t.* 51; *Hooker, i. c. pl. t.* 324; *Mountain-Mahogany* of the inhabitants of Utah.

This small evergreen tree is so well described by Nuttall in both works mentioned that not much remains to be added. His figure, however, is not a very faithful representation. He says that it grows much like a peach-tree, at most 15 feet high, and that the trunk is sometimes as much as a foot in diameter. On the expedition, it was found to grow rarely as a tree, but usually branching from the base, or several stems from one root; its height was from 8–15 feet, and the stems seen had the thickness of 3–6, or, at most, 10 inches. The bark is light gray, tough, smoothish, with superficial longitudinal wrinkles and short transverse scars. The wood is hard, heavy, very close-grained, light reddish-brown, with white sap; medullary rays very numerous, but extremely fine, scarcely visible with the naked eye; the wood is similar to cherry-wood, but harder and heavier. A specimen before me has a diameter of 16 lines, 14 lines of which are wood, showing 24 annual rings, so that each ring has a thickness of not much more than $\frac{1}{4}$ line. The shoots, or longer branches, have a white, smooth bark, with joints or internodes of about 1 inch in length. The leaves, however, are usually

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crowded at the end of lateral branchlets, a few lines to 1 or 1½ inches in length closely covered with circular scars. Leaves very thick and leathery, persistent, lanceolate, acute at both ends, entire and revolute at the margin, with a thick midrib, prominent on the lower surface, 9–14 lines long, 2½–3½ lines wide, on a petiole 1½–2 lines long, to the lower part of which adhere lanceolate, brown, scarious stipules. When young, the branchlets as well as the leaves are covered all over with short, curly hair; when older, the leaves become glabrous and glossy on the upper surface, the lower remaining hairy and assuming a rusty color. The sessile flowers are produced in June from the axils of the uppermost leaves of the preceding year's growth, either single or 2 or 3 together; short scarious bracts envelop the base of the cylindrical woolly calyx-tube, which is 3 lines long; its 5-lobed, white limb, 3–4 lines in diameter, is very woolly externally, and less so internally, and bears about 20 or 25 naked, slender filaments, with reniform anthers ½ line in diameter. Immediately after flowering, the silky-feathery style becomes elongated, and carries up with it the detached limb of the calyx; at maturity, the style becomes a twisted, feathery tail of about 2 inches in length; the inconspicuous, linear, hairy fruit itself is about 4 lines long, and remains hid in the persistent, calyx-tube; at its top and base I observe a beard of very curious, stiff, white bristles, less than a line in length, thicker in the middle, and tapering toward both extremities. The fruit seems to be somewhat persistent, as I find it in specimens collected in spring before the flowering-season. About the time of flowering, the young leaves begin to develop at the end of the branchlets, leaving the flowers between them and the leaves of the year before. I generally find 4 or 5 leaves of the same year's growth at the end of each branchlet; they probably fall off when about 15 or 18 months old.

This fine tree, discovered by Nuttall on Bear River, north of the Salt Lake, and near "Thornberg's Ravine" in the Rocky Mountains, was found by the expedition on the Lookout Mountains and other mountain-chains of the basin.

CACTACEÆ.

The geographical limits of the area of this curious American family have been considerably enlarged by this expedition, proving the presence of at least 7 species in the Utah Basin between the thirty-eighth and fortieth parallels, viz: 2 Echinocacti, 1 Cereus, and 4 Opuntiæ. Several species known before have been found in new localities, and 3 new and very distinct species have been discovered, 2 Echinocacti and 1 Opuntia.

MAMILLARIA VIVIPARA, *Haworth, Suppl. p.* 72; *Torrey & Gray, Fl. N. Am.* 2, *p.* 554; *Engelm. Synops. Cact. p.* 13; Cactus viviparus, *Nuttall, Gen.* 1, *p.* 295.

Was collected in the South Pass and on Sweetwater River. It extends from here to the mountains of Colorado and New Mexico, but its most characteristic forms are peculiar to the more elevated plains, where it assumes that cespitose, spreading appearance, from which it has received its name. The mountain form usually makes larger heads, but remains single or branches out very sparingly. Its large purple flowers, with numerous lance-linear, long acuminate, bristle-pointed petals, and its leather-brown pitted seeds, readily distinguish it from allied species.

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ECHINOCACTUS SIMPSONI (*spec. nov.**) simplex, subglobosus seu depressus, basi turbinatus, mamilliferus; radicibus fasciculatis; tuberculis laxis ovatis apice oblique truncatis axilla nudis, junioribus leviter compressis basi deorsum productis, vetustioribus obcompressis basi dilatatis; areolis ovatis seu ovato-lanceolatis, nascentibus albo-villosissimis mox nudatis; aculeis exterioribus sub 20 radiantibus tenuibus rigidis rectis albidis, additis supra aculeis 2–5 setaceis brevibus, interioribus 8–10 robustioribus obscuris erecto-patulis, areola florifera sub tuberculi apice arcolae aculeigerae contigua circulari; floribus in vertice dissitis minoribus; ovario abbreviato squamis sepaloideis triangulatis paucissimis (1–3) instructo; sepalis tubi brevis late infundibuliformis orbiculatis seu ovatis obtusis membranaceo-marginatis crenulatis fimbriatis, sepalis superioribus 10–12 ovatis obtusis integriusculis, petalis 12–13 oblongis apice crenulatis cuspidatis ex virescente roseis; stigmatibus 5–7 brevibus erectis, bacca parva viridi sicca umbilico latissimo truncata squamis paucis subinde aculeiferis instructa flore marcescente demum deciduo coronata irregulariter basi seu latere dehiscente; seminibus magnis obovatis obliquis minute tuberculatis, hilo magno ovato subbasilari, embryone circa albumen parcum fere circumvoluto hamato.

Var. *β* MINOR: tota planta, tuberculis, aculeis, floribus seminibusque minoribus.

Butte Valley in the Utah Desert, and Kobe Valley farther west; fl. in April and May, fr. in June and July. Var. *β* comes from the mountains of Colorado. This and the New Mexican *Echinocactus papyracanthus*,† the Mexican *Ech. horripilus*, Lem., and perhaps the South American *Ech. Odierii*, Lem., and *Ech. Cummingii*, Salm, and probably one or two others, form the small group of *Echinocacti*, with the appearance of *Mamillaria* (*Theloidei*, *tuberculis spiraliter dispositis distinctis*, Salm, Cact. Hort. Dyck 1849, cult. p. 34). They constitute the closest and most imperceptible transition to *Mamillaria* subgen. *Coryphantha*, Synops. Cact., p. 8, which bear the flowers in the axils of the nascent tubercules, the flower-bearing and the spine-bearing areolæ being connected by a woolly groove. In *M. macromeris*, Engelmann, they come from the middle of the tubercule (Cact. Mex. Boundary, t. 15, f. 4), and in the *Theloidei* they advance to the top of the tubercule close to the spines, thus assuming the position which the flowers regularly occupy in the genus *Echinocactus* (see Cact. Mex. Bound. t. 20, f. 2; t. 21; t. 25, f. 1; t. 27, f. 1; t. 28, f. 2).‡

The ovary is also almost naked, like that of *Mamillaria* generally, or has only a few scales, like that of *M. macromeris*. On the other hand, the dry fruit, such as is often found in *Echinocactus*, but never in *Mamillaria*, the tuberculated black seeds, and especially the large and curved embryo, and the presence of an albumen, do not permit a separation from *Echinocactus*.

This species is further interesting because it again strikingly proves that the

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* An extract of this description was published in the Transactions of the Saint Louis Academy of Sciences, vol. 2, p. 197 (1863).

† The plant I formerly described as *Mamillaria papyracantha*, Plant. Fendl., p. 49; Synops. Cact., p. 8, proves to belong to this section of *Echinocactus*. A closer examination of Mr. Fendler's original specimen shows that the floral areola joins the spiniferous one at the apex of the small nascent tubercules. Thus far Mr. Fendler's specimen, found near Santa Fé, has remained the only one ever obtained of this pretty species.

‡ *Echinocactus brevihamatus*, Engelm., forms an exception. In this species, the flowers are situated exactly as in *Coryphantha*, at the base of the tubercle, and connected with the distinct spiniferous areola by a woolly groove, (see Cact. Mex. Bound. t. 19, fs. 2 and 3).

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general appearance, the *habitus*, of a cactus plant, not necessarily indicates its real affinities. Not only is it a true *Echinocactus*, notwithstanding every appearance of a *Mamillaria*, but it is, moreover, closely allied in all its essential characters to the very compact *Ech. intertextus*, Engelm., C. Bound. p. 27, t. 34, in which all traces of tubercules are lost in the straight ribs. It has the same small flowers and the same small dry fruit, containing few large seeds, of similar structure, though not entirely the same arrangement of the spines.

Full-grown specimens of our plant are 3–5 inches high and 3–4 inches in diameter, of dark-green color; tubercules loosely arranged in $\frac{8}{21}$ or $\frac{13}{34}$ order, 8 and 13 spirals being most prominent. They are 6–8 lines long, at base somewhat quadrangular, 6–7 lines wide in the vertical and 4–5 lines in the transverse diameter, becoming subcylindric upward; areolæ 3–4 lines long, a little more than half as wide. The fruit-bearing tubercules are rather stouter and shorter. Exterior spines 4–6 lines long, whitish; interior ones spreading, stouter, and a little longer (5–7 lines long), yellowish and upward deep brown or black; no truly central spine. In the very young plant, the spines, 18–20 in number and only 1–1½ lines in length, are all radiating, closely fitting with their compressed bulbous bases on a linear areola, resembling in shape and arrangement those of *Cereus cæspitosus*. Soon afterward the areola becomes wider, and 6 or 8 short, stout, brown interior spines make their appearance, divergent like the original ones. Next the ordinary arrangement, as described above, takes place.

It seems that quite early in spring the young tubercules on the vertex of the plant begin to form, exhibiting their densely woolly tops, and soon afterward, long before any spines make their appearance, the tips of the smooth brown flower-buds come out. The flowers are 8–10 lines long and of nearly the same diameter, externally greenish-purple, petals yellowish-green or verging to pale purple. The short stamens arise from the whole surface of the tube, leaving only a very small nectariferous space in its base. The fruit is about 3 or 3½ lines long and almost as wide, borne on a very large circular areola, surrounded by a woolly margin (see t. 2, f. 1). It bears toward its top 1–3 scales, sometimes with 1 or 2 small spines in their axils. The fruit usually opens by an irregular lateral slit; falling off, its base remains attached to the areola, as is the case in many (or all? or only all the dry-fruited?) *Echinocacti*, thus producing a basal opening (see t. 2, f. 5). Seeds 1½ lines long in the longest diameter, covered with minute close-set tubercles. The young seedling shows erect, pointed cotyledons, and, when a few weeks old, begins to develop its pubescent spines.

Var. *β* has been received this fall from the Colorado gold-region;* the smallest specimens were 1 inch in diameter, globose, the small tubercules in $\frac{8}{21}$ order, spines 1½–2 lines long, often curved; sometimes 1–3 darker stouter ones in the center. The larger specimens are almost of the size of those of Utah, but often depressed at top; tubercules arranged in $\frac{13}{34}$ or even $\frac{21}{54}$ order, spines only 4–5 lines long, 20–28 external and 6 or 7 internal ones.

This species has been named in honor of the gallant commander of the expedition.

* It here grows and thrives probably at a higher elevation than any other northern Cactus, occupying *e. g.* the gravelly moraines of the Glacial period of Clear Creek Valley, between 8,000 and 9,000 feet altitude, and in the southern part of the Territory, the Sangre de Cristo Pass, 10,000 feet high (January, 1876).

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Plate 1. *Echinocactus Simpsoni* as it appears in early spring; on the vertex a young growth of tubercules is visible, their tops covered with wool.

Plate 2. Details of the same.

Fig. 1. Four tubercules from near the vertex, one shows the broad scar where the fruit has fallen off, another one is just developing its spines, exhibiting their points above the thick wool.

Fig. 2. A detached tubercule bearing a ripe fruit.

Figs. 3 and 4. Flowers with the upper part of the tubercule and its young spines.

Figs. 5 and 6. The fruit magnified three times; fig. 5 showing the basal opening, fig. 6 the broad umbilicus.

Fig. 7. A scale of this fruit, more magnified, with two axillary spines.

Figs. 8–12. Seed: fig. 8 natural size, the others eight times magnified; fig. 9 lateral, fig. 10 dorsal, fig. 11 basal view; fig. 12 part of the surface, highly magnified.

Fig. 13. Embryo, enveloped in the inner seed-coat, including also the albumen; magnified.

Fig. 14. Lateral, fig. 15 frontal view of the embryo, magnified.

Fig. 16. Seedling, a few weeks old, magnified.

Fig. 17. Tubercules of the smaller variety from Colorado, in every state of development.

ECHINOCACTUS PUBISPINUS (*spec. nov.*)* parvulus, turbinatus, costis 13 subobliquis compressis interruptis tuberculatis; areolis orbiculatis, aculeis brevibus, rectis seu sæpe curvatis albidis apice adustis velutinis demum nudatis; radialibus superioribus 1–2 robustioribus, longioribus rectis curvatis seu hamatis, ceteris 5–8 brevioribus; aculeo centrali deficiente seu singulo robustiore longiore arrecto sursum hamato; flore ?; fructu ?.

Pleasant Valley, near the Salt Lake Desert, found May 9 without flower or fruit. Plant 2 inches high, 1 or $1\frac{1}{4}$ in diameter; compressed tubercules 4–6 lines distant from one another, confluent in 13 ribs, radial spines 1–4 lines long, white pubescent or almost tomentose, more so than I have observed it in any other cactus; on the lower areolæ, I find only 5–6 spines, the upper ones a little longer and stouter than the balance; farther upward, the number increases to 10, one or more of the upper ones becoming still stouter and often hooked; at last here and there a single central spine makes its appearance, 5–6 lines long, the strong hook always turned inward or upward. At first, only the dusky point of the spine is naked; with age, the whole coating seems to wear off. In another specimen, I find the spines 8–12 in number, a little longer, more slender, all radiating. The small supraspinal areola proves this plant to be an *Echinocactus;* it probably belongs, together with the next, to the section *Hamati*, Synops. Cact. p. 15.

ECHINOCACTUS WHIPPLEI, *Engelm. & Bigelw, Pacif. R. Rep. IV, Cact. p.* 28, *t.* 1, *Syn. Cact. p.* 15. Var. SPINOSIOR: globosus; costis 13 compressis interruptis; aculeis radialibus 9–11, inferioribus sæpe obscurioribus, reliquis longioribus niveis, 2 superioribus sæpe

* This description has been published in Trans. Acad. St. Louis, vol. 2, p. 199 (1863). It is rather strange that neither this nor the above-mentioned *E. papyracanthus* has ever been found again (January, 1876).

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elongatis complanatis curvatis; centralibus 4, summo elongato complanato pergamentaceo flexuoso albo, 3 reliquis paullo brevioribus obscuris omnibus seu solum infimo hamatis; floribus minoribus; ovario squamis sepaloideis 5 oblongis munito; sepalis tubi linearibus margine membranaceis integris mucronulatis, petalis angustis oblongis; stigmatibus 6–7 brevibus in capitulum globosum congestis; bacca ovata parce squamata floris rudimentis persistentibus coronata.

The species was originally discovered on the Little Colorado by Dr. Bigelow, and was found afterward on the same stream by Dr. Newberry; the variety here described was met with more than 5 degrees farther north, in Desert Valley, west of Camp Floyd; remains of fruit, with the withered flowers attached, and some seeds, were found concealed between the spines from which the description has been drawn.* Globose heads 3 inches in diameter, radial spines $\frac{1}{2}$–$1\frac{1}{2}$ inches long, central ones $1\frac{1}{2}$–2 inches in length; flowers, if I may judge from the withered remains, about 1 inch long; ovary small, bearing about 5 membranaceous scales, the lower triangular, the upper oblong-linear, almost entire, and never cordate or auriculate at base, as they appear in most of the allied species; sepals of tube also narrow, linear, or oblong-linear, 2–5 or 6 lines long, $\frac{1}{2}$–1 line wide, stigmas about $\frac{1}{2}$ line long. Fruit apparently an oval berry, $\frac{1}{2}$ inch long; seed just as it is described and figured in Whipple's Cactaceæ; the tubercules on the seed-coat are extremely minute and distant from one another, each forming a central protuberance on the otherwise flat surface of an angular cell of two or three times the diameter of the tubercule itself; embryo curved about $\frac{3}{4}$ around a rather copious albumen.

CEREUS VIRIDIFLORUS, *Engelm. in Wisliz. Mem. note* 8, *sub Echinocereo; Cact. Mex. Bound. t.* 36; *Synops. Cact. p.* 22.

This is evidently the northernmost *Cereus*, extending to the Upper Platte; it is abundant in Colorado. These northern specimens are 1–3 inches high, 13-ribbed, and show the greatest variability in the color of the radial spines; in some bunches, they are all red, in others white, in others again the colors are distributed without much regularity; sometimes the upper and lower spines are white and the lateral ones red, or a few or even a single one above and below are red and all the rest white; or the lower ones are red and the upper ones white, and all these variations sometimes occur on the same specimen. I mention this to show how little reliance can be placed on the colors or the distribution of the colors of the spines. Central spines wanting or 1 or 2 projecting horizontally, straight or curved upward, white or tipped with purple or all purple, 6–9 lines in length.

CEREUS ENGELMANNI, *Parry in Sillim. Journ. n. ser.* 14, *p.* 338; *Engelm. Cact. Bound, p.* 36, *t.* 57; *Synops. Cact. p.* 27.

Deserts west of the Salt Lake, without flower or fruit. Specimen entirely similar to the one figured in the Cactaceæ of the Boundary. The species seems to extend from the Salt Lake region southwestwardly to Arizona and the Mohave country.

* The botanist of Dr. Hayden's Expedition of 1875, Mr. Brandegee, found it abundantly in Southwestern Colorado (January, 1876).

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OPUNTIA SPHÆROCARPA, *Engelm. and Bigelow, Pac. R. Rep. IV, Cact. p.* 47, *t.* 13, *fs.* 6–7; *Syn. Cact. p.* 44. Var.? UTAHENSIS: diffusa, læte-virens, articulis orbiculato-obovatis, crassis, junioribus sæpe globoso-obovatis; areolis subapproximatis; foliis minutis subulatis divaricatis; setis brevissimis paucis stramineis; aculeis nullis seu parvulis nunc singulo longiore recto robusto albido; floribus sulphureis, ovario obovato areolis fusco-tomentosis sub-25 instructo, sepalis exterioribus transversis obcordatis cuspidatis; petalis 8 late-obovatis emarginatis; stylo vix supra stamina exserto; stigmatibus 8 brevibus erectis; bacca obovata areolis plurimis tomentosis stipata; seminibus numerosis irregulariter compressis anguste marginatis.

Pass west of Steptoe Valley, in the western mountains of the Basin, found July 19 in flower and fruit. Joints 2–3 inches long and of almost the same diameter; often over $\frac{1}{2}$ inch in thickness, sometimes almost terete or rather egg-shaped; areolæ 6 or 8 lines apart; leaves very slender and acute, scarcely 1 line long, smaller than in any other of our species except *O. basilaris*, also a western form from the Lower Colorado. Bristles few, and even in old joints scarcely more than $\frac{1}{2}$ line long; spines none, or on the upper areolæ a few short ones, with here and there a stouter one $\frac{3}{4}$–1 inch in length. Flowers nearly 3 inches in diameter, pale or sulphur-yellow, when fading, reddish; fruit about 1 inch long and half as wide, with a deep umbilicus, and with 20–25 areolæ, which sometimes show a few bristles or a minute spine; seeds very irregular, 2, or, in the largest diameter, sometimes $2\frac{1}{2}$ lines wide.

Unwilling to increase the number of illy-defined species in this most difficult genus, I attach this plant to the only species known to me to which it possibly can be compared, *O. sphærocarpa* from New Mexico, though its fruit is not spherical, has not a shallow umbilicus, and is, at least in the specimen before me, not dry; the latter would be an insuperable distinction, if we might not suspect, what in fact is often the case, that the fruit later in the season would become dry and brittle. The leaves, which heretofore have been entirely too much neglected as a diagnostic character in this genus, and the flowers of the original *O. sphærocarpa*, are unknown thus far.

OPUNTIA TORTISPINA, *Engelm. & Bigelow, l. c. p.* 41, *t.* 8. *fs.* 2–3; *Syn. Cact. p.* 37.

Forks of the Platte; in flower in July. The specimens being very incomplete, I am not quite sure that this is the same species as that of Captain Whipple's Expedition; the joints appear to be somewhat smaller, the areolæ closer together, and the spines shorter (1–$1\frac{1}{2}$ inches) and rather weaker; it may possibly prove to be an extreme form of *O. Rafinesquii*, the area of which extends to the Rocky Mountains. Leaves subulate, 2 lines long; flowers $2\frac{1}{3}$–3 inches in diameter, sulphur-yellow; ovary long (1–$1\frac{1}{2}$ inches), with 20–30 areolæ, with light-brown wool and short bright-brown bristles; exterior sepals obovate, lance-cuspidate; petals 6–8, broadly obovate, obtuse, crenulate; stigmas 6–8, short, erect, as long as the stamens.

OPUNTIA HYSTRICINA, *Engelm. & Bigelow, l. c. p.* 44, *t.* 15, *fs.* 5–7; *Syn. Cact. p.* 43.

A flowering specimen, collected in June between Walker and Carson Rivers, is exactly like one found by Dr. Bigelow on the Colorado Chiquito; it has slenderer and straighter spines than the one figured in Whipple's Report, and approaches somewhat to *O. erinacea*, E. & B., of the Mohave region, in which I now recognize the long-lost

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O. rutila, Nutt. in Torr. & Gray Flor. 1, p. 555. Joints 5 inches long, half as wide, obovate; leaves 1½ lines long; areolæ closely set with long straw-colored bristles; lower ones with few and short white spines, upper ones with numerous grayish-red spines, 1½–2 inches in length. Flowers pale straw-colored, 2½–3 in diameter; ovary 1 inch long, with 20–30 white woolly aculeolate areolæ; exterior sepals oblanceolate, squarrose, or recurved at the elongated tip; petals obovate, obtuse, crenulate; style with 8 or 10 short erect stigmas, longer than the stamens. The squarrose tips of the sepals are particularly conspicuous on the bud.

Opuntia Missouriensis, *De Cand. Prod.* 3, *p.* 472; *Torr. & Gray, Fl.* 1, *p.* 555 (*in part*); Cactus ferox, *Nutt. Gen.* 1, *p.* 296.

From the deserts of Salt Lake Valley to Rush Valley; specimens without flower or fruit. Joints small (2–3 inches long), broadly obovate or circular; areolæ closely set; spines numerous, stiff, stout, angular, white, mostly deflexed.

Opuntia Missouriensis, var. albispina, *Engelm. & Bigelow, l. c. p.* 46; *t.* 14, *fs.* 8–10; *Syn. Cact. p.* 44.

Smith Creek, Lookout Mountains, in Western Utah; flowering in July. By their slender flexuous spines, the specimens approach to var. *trichophora.* Flowers 3–3½ inches in diameter, bright golden-yellow; ovary 1 inch long, with 20 or 25 areolæ, scarcely spiny; exterior sepals obovate, cuspidate; petals about 8, obtuse, crenulate; style shorter than the stamens; stigmas about 5, very short, erect. Some flowers have elongated and very spiny ovaries, evidently abortive.

Opuntia fragilis, *Haworth, Suppl. p.* 82; *Torr. & Gray, Fl.* 1, *p.* 555; *Synops. Cact. p.* 45; Cactus fragilis, *Nutt. Gen.* 1, *p.* 296.

Fort Kearny to the North Platte country; in flower in June and July. This is, I believe, the first time that the flowers of this species were collected since Nuttall's discovery of it in 1813. Travelers report that the plant is very frequently seen in the sterile prairies east of the Rocky Mountains, but that it is rare to find them in flower and rarer still in fruit. Since many years I have the plant in cultivation from specimens brought down by Dr. Hayden, but have not been able to get it to flower. Nuttall only informs us that the flowers are solitary and small. In the specimen before me, they are yellow, scarcely 2 inches in diameter; ovary 8–9 lines long; the 13–15 areolæ are densely covered with thick white wool; the upper ones bear a few white spines; lower sepals broadly oval, with a short cusp; petals 5, obovate, rounded, crenulate; style longer than the stamens; stigmas 5, short, erect, cuspidate.*

* Through the kindness of Dr. A. W. Chapman, of Apalachicola, Fla., I have received living specimens and fruit of *O. Pes Corvi*, so that I can now complete the description of this very distinct southern species.

Opuntia Pes Corvi, *Le Conte in herb. Engelm.; Append. to Synops. Cact. in Proceed. Am. Acad. Arts & Sc.* 3, *p.* 346; *Chapman, Fl. South. U. S. p.* 145: diffusa, læte viridis; articulis parvis ovatis seu obovatis tumidis sæpius teretiusculis concatenatis fragilibus; pulvillis subdistantibus pulvinatis; foliis teretiusculis ovatis cuspidatis incurvis; areolis junioribus albo-tomentosis setas parcas brevissimas pallidas et plerisque aculeos 1-3 rectos rigidos sæpe basi compressos tortosve obscuros gerentibus, infimis inermibus; floribus flavis minoribus; ovario obovato pulvillos perpaucos fusco-villosos gerente; sepalis exterioribus ovato-lanceolatis, interioribus obovatis cuspidatis; petalis sub-5 obovatis spatulatis obtusis; stylo stamina æquante, stigmatibus 4–5 erectis; seminibus paucissimis anguste obtuseque marginatis in pulpa viscosa baccæ parvæ rubræ sæpe floris rudimentis coronatæ nidulantibus.

Barren sandy places along the coast of Georgia and Florida. Joints 1–3 inches long, obovate tumid, or narrower

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OPUNTIA PULCHELLA (*spec. nov.*) :* parvula cæspitosa diffusa; articulis parvis obovato-clavatis; foliis minutis e basi ovata subulatis; areolis confertis, superioribus aculeos albidos rectos, singulum longiorem complanatum porrectum seu deflexum alios brevissimos radiantes gerentibus; floris purpurei ovario areolis 13–15 convexis albo villosissimis et longe setosis dense stipato; sepalis inferioribus lineari-oblongis breviter cuspidatis, superioribus spatulatis; petalis sub-8 obovatis obtusis, stylo cylindrico exserto, stigmatibus 5 linearibus suberectis; bacca sicca setosissima, seminibus crassis rhaphe lata plana notatis.

Sandy deserts on Walker River;† fl. in June.

This is one of the smallest, as it is one of the prettiest, species of this genus. It belongs to the small section of *Clavatæ* (Synops. Cact. p. 46) of the cylindric *Opuntiæ*, but is distinct from all those known to me by its small joints and purple flowers; all the others have, so far as I know, yellow flowers. Joints 1–1¼ inches long, 4–6 lines thick, very slightly tuberculated; leaves scarcely one line long; areolæ crowded, white woolly; larger central spine on the upper areolæ 4–6 lines long, flat, and somewhat rough above, convex below; smaller ones 4–6 or 10, radiating, ½–1½ lines long; flowers crowded, of a beautiful bright purplish-red or deep rose-red color, 1¼–1½ inches in diameter; ovary 4–5 lines long, beset with white capillary spines, 3–5 lines long, 15–20 on each areola; style not ventricose, as is usual in the genus, but cylindric; stigmas slender, pale yellow; berry clavate, at last dry, about 1 inch long, well marked by the conspicuous white-woolly areolæ and their numerous purplish-brown, flexible, hair-like bristles, 4–6 or 7 lines long. These bristles are entirely destitute of the minute barbs which otherwise invariably characterize spines and bristles of *Opuntiæ*. The thick round seeds, 2 lines in diameter, are well distinguished by a broad rhaphe, much wider than I have seen it in any other clavate *Opuntia*.

Plate 3, Fig. 1. Part of a plant of *Opuntia pulchella*, showing a flower-bud and two flowers, natural size.

Figs. 2–4. Bunches of spines, 4 times the natural size.

Fig. 5. Section of a larger spine, more magnified.

Fig. 6. A leaf from an ovary with the axillary woolly and bristly areola, 4 times natural size.

Fig. 7. A fruit.

Figs. 8–9. Seed, 4 times magnified; fig. 9 showing the broad rhaphe.

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and cylindric, fresh or dark green, usually growing one on top of the other, forming chains of 1 or 2 feet long, at last prostrate; joints fragile, separating as readily as in *O. fragilis;* tumid pulvilli 4-6 or even 8 lines apart; leaves 2½–3½ or 4 lines long, incurved; spines 1–1½ inches long, very straight, when in threes divergent like the "crowsfoot" used against cavalry, whence the name given by the military gentlemen who discovered this species. Flowers 1½–1¾ inches in diameter; sepals and petals less numerous and narrower than in any allied species; ovary about ½ inch long, with only 2 or 3 areolæ on the surface and 3–5 on the upper margin. Fruit obovate, 6–7 lines long, rose-purple, with a shallow umbilicus, oftened crowned with the blackened remains of the flower; areolæ almost obliterated; red pulp very glutinous, including 1–3 or at most 5 seeds, which are regularly shaped, lenticular, with a narrow but thick and very obtuse rim. By its pulpy fruit, this species is widely removed from *O. fragilis,* to which its tumid and fragile joints seem to ally it, nor can it be confounded with any other species, though allied to *O. vulgaris* and *O. Rafinesquii.*

* An account of this species was given in the Transactions of the St. Louis Acad. 2, p. 201 (1863).

† This pretty species was afterward collected, 1867, "among the sage brushes" of Nevada, by Mr. William Gabb and in the following year by Mr. S. Watson "frequent in the valleys of Western Nevada from the Trinity Mountains to Monitor Valley, 4–5,000 feet alt."

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COMPOSITÆ.

The name of "*Wild Sage*", now so familiar to every traveller in our western mountain-deserts, was first used by Lewis and Clarke, in the narrative of their adventurous expedition, to designate several species of *Artemisia* or *Wormwood*, distantly resembling the true garden sage, *Salvia officinalis*, by their gray foliage and aromatic odor. It seems that now this name has, by common use, been restricted to the larger shrubby species, which give a peculiar character to the arid plateaus of Western North America, and which are of the highest importance to the traveller as "furnishing the sole article of fuel or shelter which they meet in wandering over these woodless deserts", as already Nuttall informs us in his genera of North American Plants, 2, p. 142. He states that the "Wild Sage" is his *Artemisia Columbiensis*, which name was by him improperly substituted for the prior name of *A. cana*, described by Pursh from the original specimens of Lewis and Clarke. Torrey and Gray, in their Flora of N. America, 2, p. 418, doubt whether this really is the "Wild Sage" of those travelers, and come to the conclusion that that name was indiscriminately applied to several shrubby species; they further state that the plant given by Governor Lewis to Pursh as "the Sage" is the herbaceous *A. Ludoviciana* found on the homeward voyage on the Missouri River.

I have now the means, through information obtained from Mr. H. Engelmann and from Dr. F. V. Hayden, to throw a little more light on this question, which is not without importance for botanical geography. The two species here in question are—

ARTEMISIA CANA, *Pursh, Fl. Am. sept.* 2, *p.* 521; *Torrey and Gray, Fl. N. Am.* 2, *p.* 418.—Shrubby, with woody stem 2–4 inches in diameter, 2–4 feet (on the Yellowstone, Dr. Hayden) or 2–6 feet high (on the Laramie Plains, H. Engelmann). Stem covered with a light-gray bark, which is separated into many layers of loose shreds connected by smaller transverse fibers, and is readily torn off. Wood light, porous, pale-colored, with very many darker brown medullary rays, easily separating along the division of the annual rings. These rings, or layers, are from $\frac{1}{2}$–1 line in thickness, as stems of $1\frac{1}{2}$–2 inches diameter show about a dozen rings, and are consequently as many years old. The stems are rarely cylindrical, but mostly compressed, knotty, and variously twisted, and often stunted; they are sometimes divided from the base, but oftener bear short and thick branches higher up. The annual branchlets are crowded along the older branches, 8–12 inches long, densely coated with a soft, white pubescence, and crowded with silvery-gray leaves, and bear toward their upper part and on the numerous short and erect lateral branchlets a profusion of small flower-heads, forming a spiked or contracted panicle, interspersed with short leaves. The leaves are flat, linear-lanceolate, entire or (the lower ones) rarely lobed, 1–2 or $2\frac{1}{2}$ lines wide and $1\frac{1}{2}$–2 inches long, the upper ones becoming smaller. The flower-heads are mostly sessile, or nearly so, hemispherical, about 2 lines long and wide; outer scales of involucrum shorter, foliaceous, and canescent (sometimes the lowest ones larger than the flowers, and pointed); inner scales nearly as long as flowers, brownish, scarious, obtuse, cottony-fimbriate on the margins. The flowers are all perfect, usually 5, in some specimens as many as 8 in number, $1\frac{1}{2}$ lines long; ovary glandular, and, when bruised, with the odor of wormwood.

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This is the "Wild Sage" of the Upper Missouri (above the mouth of the Yellowstone) and the Yellowstone River, and of the Laramie Plains, but it does not seem to occur west of the Rocky Mountains, as Torrey and Gray (*l. c.*) already state, and Nuttall (*l. c.*) must have confounded it with other species, when he contends that it is "still more abundant on the barren plains of the Columbia River", and that it grows 6 to 8 or 12 feet high.

ARTEMISIA TRIDENTATA, *Nuttall in Trans. Amer. Phil. Soc.* (*n. ser.*) 7, *p.* 398; *Torrey and Gray, Fl.* 2, *p.* 418.—Trunk, bark, and wood very similar to that of the last species, but trunk often larger, and usually even more twisted and knotty, with very numerous short and stunted branches, which are repeatedly divided into a great many smaller branchlets; ultimate annual branchlets fascicled, erect, only 3–6 inches long, canescent or silvery, very leafy at base, rather naked upward, bearing strict, rather compact, paniculate spikes, composed of sessile or usually pedunculate spikelets or glomerules of 3 to 6 or 8 sessile heads. Leaves silvery-white on both surfaces, crowded at the base of the branches, and often fascicled on short or stunted sterile branches, narrowly wedge-shaped, $1\frac{1}{2}$–2 lines wide at the obtuse tridentate or trilobed end, narrowed down into a more or less distinct petiole; usually 3–6, rarely 8, lines long. Inflorescence interspersed with short and narrow, undivided, cuneate or spatulate obtuse leaves. Heads of flowers narrow, obovoid, nearly $1\frac{1}{2}$ lines long, not much more than half as wide, with short and obtuse, canescent, exterior scales, and longer, scarious, interior scales, ciliate on the sides. Flowers in some specimens 3, in others often 4–5 in each head, all perfect, scarcely more than 1 line long; ovary quite glandular and with the odor of turpentine.

This is the "Wild Sage" of Utah, and, perhaps, of the whole region west of the Rocky Mountains, where it seems to supplant the more eastern *A. cana*. Nuttall, who first described it, calls it a shrub about a foot high, and as such it appears in the mountains of Colorado; but in Utah it is the largest and most abundant species, usually 2–4 feet high, rarely attaining a height of 6 feet, and then not straight, and with trunks of 3–6 inches diameter; sometimes the smallest bushes have trunks fully as thick as the tallest ones, short and chunky. East of the mountains, in the range of *A. cana*, it ever remains an inconspicuous shrub, lost among the more common species. Near Camp Floyd, specimens were collected bearing white tomentose excrescences of the size of a pea, or larger, undoubtedly galls caused by the sting of insects; the same have been observed on this species in Colorado.

The other species of *Artemisia* collected by the expedition were *A. Canadensis*, Michx., at Bridger's Pass; *A. Ludoviciana*, Nutt., at Sweetwater, Bridger's Pass, Round Prairie, etc.; *A. dracunculoides*, Pursh, on the Sweetwater; and *A. frigida*, Willd., on the Upper Sweetwater River.

CHENOPODIACEÆ.

SARCOBATUS VERMICULATUS, *Torrey in Emory's Report* (1848), *p.* 149. Batis (?) vermiculata, *Hooker, Flor. Bor.-Am.* 2, *p.* 128 (1840); Sarcobatus Maximiliani, *Nees in Pr. Maximil. Trav. Engl. ed. p.* 518 (*ex Torrey*), *Seubert in Bot. Zeitung*, 1844, *p.* 753, *cum tab., Lindley in Hooker, Lond. Journ. Bot. IV, p.* 1 (1845); Fremontia vermicularis,

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Torrey in Frémont's First Report, 1843, *Rept.* 1845, *p.* 95, *and Frémont's Second Report*, 1845, *p.* 317, *tab.* 3; Sarcacanthus, *Nuttall in Pl. Gambel, p.* 184; Sarcobatus vermicularis, *Torrey in Sitgr. Rep. p.* 169, *in Stansb. Rep. p.* 394, *in Bot. Whipple, p.* 130;* *Pulpy Thorn* or *Pulpy-leaved Thorn* of Lewis and Clarke; *Greasewood* of the present travelers and settlers.

This curious and important plant is found on the arid saline plains, principally on clayey soil, which in the wet season is moist, and on the border of salt-lakes, often covering large patches, from below Fort Pierre on the Missouri (*Dr. Hayden*) to the Upper Platte River (*Frémont, H. Engelmann*), and Upper Canadian (*Dr. James*) east of the Rocky Mountains to the plains of the Columbia (*Lewis and Clarke, Douglas, Frémont*), Utah (*Frémont, Stansbury*) through the Basin to Carson Valley (*H. Engelmann*) and down to the Gila River (*Emory*). Though discovered and noticed by Lewis and Clarke (1804) and collected by Dr. James (1819), this shrub was first described, 1840, by Hooker, in his North American Flora, from Oregon specimens, and was doubtfully referred by him to *Batis*. A few years later, it was again described by Nees in his account of the plants collected by the Prince of Neu Wied as a new genus under the name of *Sarcobatus*, and very soon afterward, and without a knowledge of the publication by Nees, again by Torrey under that of *Fremontia*. It is a great pity that this last name had to give way to priority, though at present a much handsomer and showy Californian shrub bears Frémont's name, the wide-spread *Greasewood* of the western mountains and deserts would more fitly have commemorated the bold and hardy pioneer of explorers to the millions, who now do or in time to come will know and value this plant.

The *Greasewood* forms a scraggy, stunted shrub, 2 or 3 to as much as 6 or 8 feet high; in Utah, it is commonly 3–4 feet high. The stems are scarcely ever more than 1 or 2 and rarely 3 inches thick, knotty, flattened, twisted, and often with irregular ridges and holes (the scars of decayed branches); sometimes, however, many straight shoots issue from a single base, $\frac{1}{4}$–$\frac{1}{2}$ inch thick, so straight as to be used for arrows. They are covered with a compact, smoothish or slightly roughened, light-gray bark. The wood is very hard and compact, of light-yellow, in the core light-brownish, color, with very thin annual layers, in younger plants about $\frac{1}{3}$, in older ones $\frac{1}{4}$ of a line or less thick. The oldest stems seen showed 20–25 rather indistinct rings, and were consequently so many years old. The numerous smaller branches have a smooth, shining, white bark, and are beset with white spines at right angles; these spines are indurated branches of two kinds. The sharper and shorter ones are real spines, scarcely ever more than $\frac{1}{2}$–1 inch long; they bear leaves only, or, in the axils of these, female flowers, and are terminated by a sharp point and never by a staminate spike. The other spines are branchlets which did bear such a terminal spike, which, after flowering, has fallen away; they are 1–2 inches long, sometimes even longer, when they are apt to bear also lateral spines. The flower-bearing branches are very often secondary axillary productions closely under the sterile primary branch, which constitutes the spine, so that the spines often appear as axillary to the flower-bearing branches. The leaves are thick and pulpy, linear, or often narrowed toward the base, flattened or even slightly

* Compare S. Watson's Revision of the American Chenopodiaceæ in Proc. Am. Ac. Arts Sc. vol. 9, p. 82 (1875).

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channeled on the upper surface, and keeled on the lower one, at least toward the base, leaving a triangular scar after falling off. They are ½–1 inch, rarely as much as 1½ inches long, and ½ line, or sometimes, in the upper half, even 1 line, wide; in young and vigorous shoots, I have seen the leaves flatter, shorter, and broader, almost lanceolate. Their surface usually is perfectly glabrous; in specimens from Carson Lake, however, I find the younger leaves covered with a rough and sometimes branched pubescence. The leaves are sometimes on the lower part of the branches opposite, but commonly alternating in ⅖ order. The staminate and pistillate flowers are both very imperfect, but very different in their arrangement and structure; they usually occur on the same plant, though some plants seem to bear scarcely any but staminate, others only pistillate, flowers. The staminate flowers are crowded into a deciduous spike or ament, terminating the branches. This spike is, before the flowers open, 3–5 lines long and 1½ lines thick, and very compact, exhibiting only the rhombic surfaces of the scales; afterward it elongates to the length of 5–9 lines, showing the deciduous anthers under and between the separated scales. The spike consists of 25–35 peltate angular scales, pointed at the upper end, which cover 3–5 broadly oval anthers, sessile on the rhachis, ½ line long, 2–celled, opening laterally. The fertile flowers are usually solitary in the axils of the leaves and sessile; in some specimens, I find a secondary flower just below the primary one, and sometimes even below a branch, springing from the same axil; sometimes they are aggregated on abbreviated branchlets, forming irregular clusters. The flower consists of a tubular calyx with an inconspicuous rim, investing the lower half of the ovary, which is terminated by two unequal subulate stigmas, lateral in regard to the stem. In the fruit, this rim is enlarged to a broad, circular, spreading wing, 3–5 lines in diameter, green or sometimes red, which surrounds the upper third of the fruit. The flattened vertical seed, inclosed in the membranaceous utriculus, is about 1 line in diameter, and contains a spiral embryo without an albumen, as already demonstrated and figured by Professor Torrey in Frémont's Report.

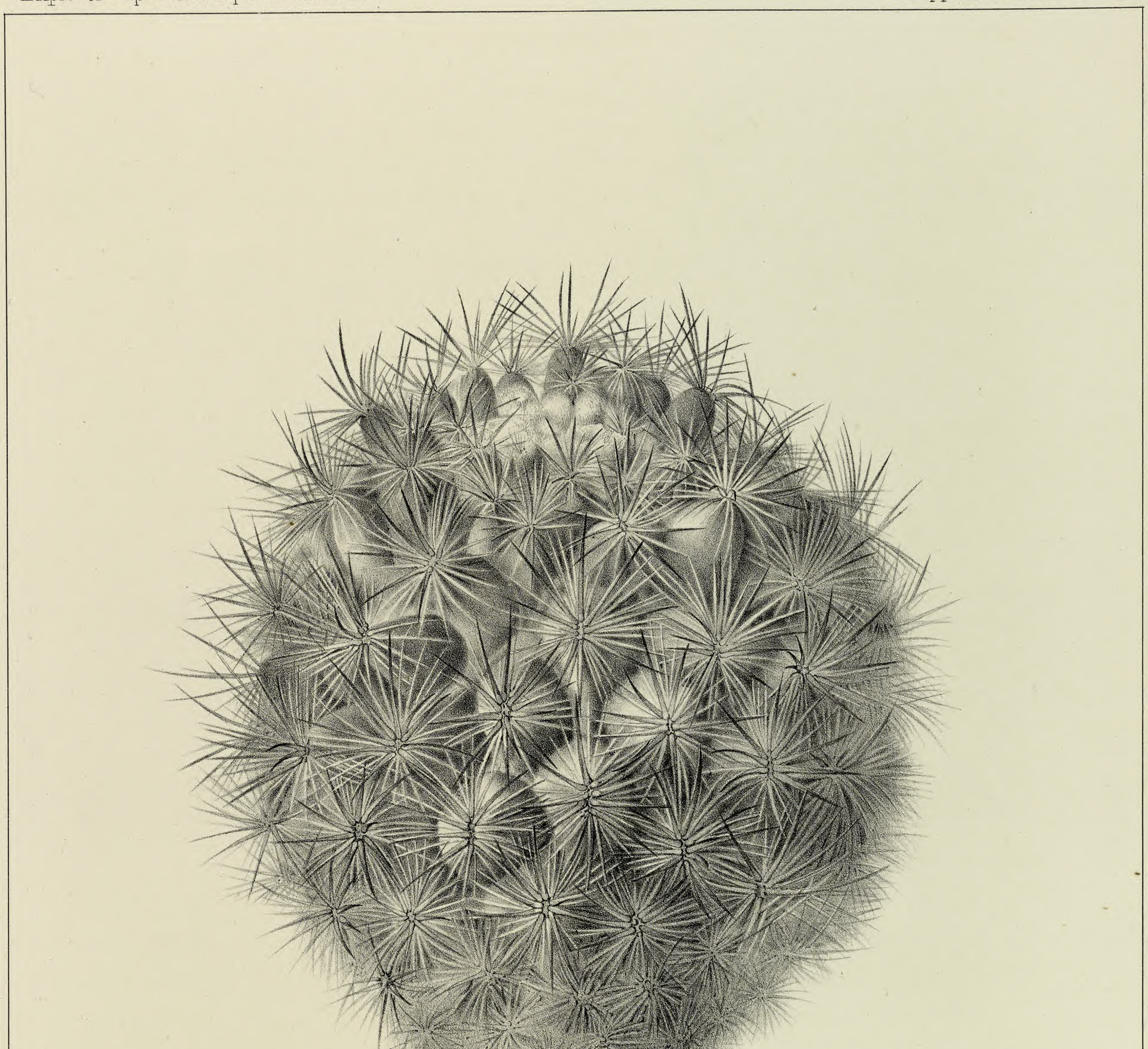
The Greasewood is found in flower from June to August.

The form from Carson Lake seems to be distinguished not only by the pubescence of the younger parts of the plant, but also by its more squarrose growth, its subdiœcious flowers, and its aggregated fertile flowers and fruits; but the Greasewood of other localities is also often subdiœcious, so that when first described, it was considered a truly diœcious plant.

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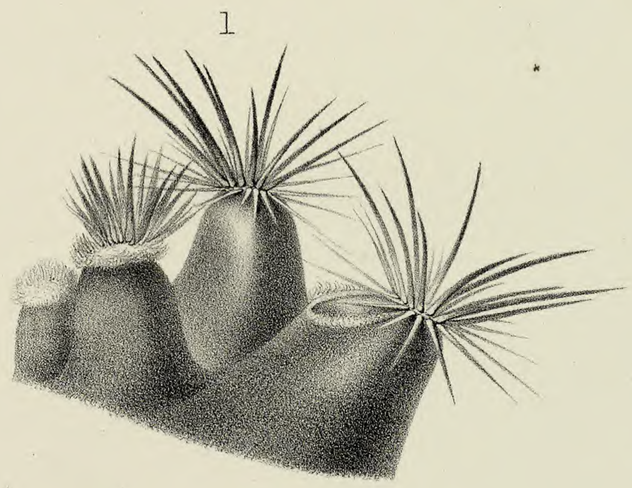


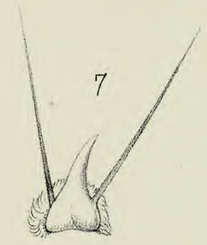
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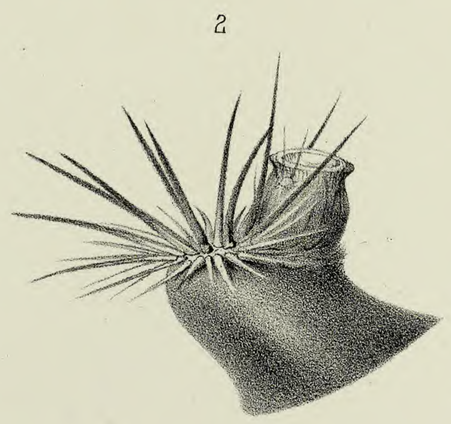
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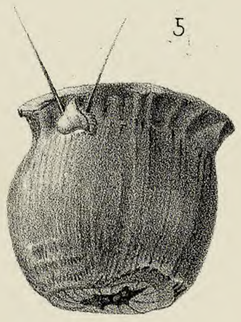
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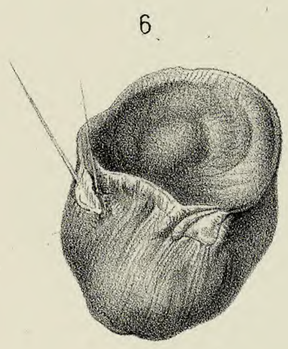

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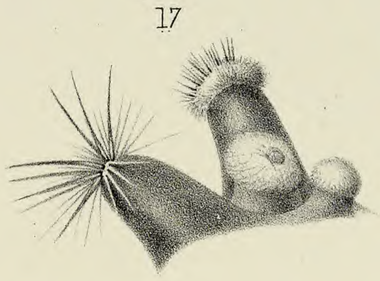

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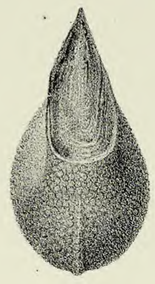

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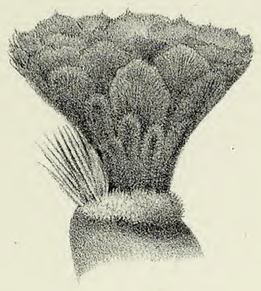

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OPUNTIA PULCHELLA, ENGELM.

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EXPLORATIONS ACROSS THE GREAT BASIN OF UTAH IN 1859.

IN CHARGE OF CAPT. J. H. SIMPSON, TOPOGRAPHICAL ENGINEERS.

REPORT

ON THE

BOTANY OF THE EXPEDITION.

BY

Dr. GEORGE ENGELMANN.

WASHINGTON:
GOVERNMENT PRINTING OFFICE
1876.

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APPENDIX M.

REPORT

ON THE

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BY

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APPENDIX M.

SAINT LOUIS, *December* 31, 1860.

DEAR SIR: Want of time has prevented me fully to elaborate the very rich botanical material brought together, under your orders, by my brother, Henry Engelmann, the geologist and meteorologist of your expedition.

I herewith inclose to you an account of a few species, which seem to have a particular, and principally a practical, interest.

I expect to continue my investigations, and hope to submit them, through you, to the scientific public at a future period.

Very respectfuly, &c.,

GEORGE ENGELMANN.

Capt. J. H. SIMPSON,
Topographical Engineers, U. S. A., Commanding Expedition.

ROSACEÆ.

CERCOCARPUS LEDIFOLIUS, *Nuttall in Torrey and Gray's Fl. N. Am.* 1, *p.* 427; *and in his continuation of Michaux's Sylva*, 2, *p.* 28, *t.* 51; *Hooker, i. c. pl. t.* 324; *Mountain-Mahogany* of the inhabitants of Utah.

This small evergreen tree is so well described by Nuttall in both works mentioned that not much remains to be added. His figure, however, is not a very faithful representation. He says that it grows much like a peach-tree, at most 15 feet high, and that the trunk is sometimes as much as a foot in diameter. On the expedition, it was found to grow rarely as a tree, but usually branching from the base, or several stems from one root; its height was from 8–15 feet, and the stems seen had the thickness of 3–6, or, at most, 10 inches. The bark is light gray, tough, smoothish, with superficial longitudinal wrinkles and short transverse scars. The wood is hard, heavy, very close-grained, light reddish-brown, with white sap; medullary rays very numerous, but extremely fine, scarcely visible with the naked eye; the wood is similar to cherry-wood, but harder and heavier. A specimen before me has a diameter of 16 lines, 14 lines of which are wood, showing 24 annual rings, so that each ring has a thickness of not much more than $\frac{1}{4}$ line. The shoots, or longer branches, have a white, smooth bark, with joints or internodes of about 1 inch in length. The leaves, however, are usually

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crowded at the end of lateral branchlets, a few lines to 1 or 1½ inches in length closely covered with circular scars. Leaves very thick and leathery, persistent, lanceolate, acute at both ends, entire and revolute at the margin, with a thick midrib, prominent on the lower surface, 9–14 lines long, 2½–3½ lines wide, on a petiole 1½–2 lines long, to the lower part of which adhere lanceolate, brown, scarious stipules. When young, the branchlets as well as the leaves are covered all over with short, curly hair; when older, the leaves become glabrous and glossy on the upper surface, the lower remaining hairy and assuming a rusty color. The sessile flowers are produced in June from the axils of the uppermost leaves of the preceding year's growth, either single or 2 or 3 together; short scarious bracts envelop the base of the cylindrical woolly calyx-tube, which is 3 lines long; its 5-lobed, white limb, 3–4 lines in diameter, is very woolly externally, and less so internally, and bears about 20 or 25 naked, slender filaments, with reniform anthers ½ line in diameter. Immediately after flowering, the silky-feathery style becomes elongated, and carries up with it the detached limb of the calyx; at maturity, the style becomes a twisted, feathery tail of about 2 inches in length; the inconspicuous, linear, hairy fruit itself is about 4 lines long, and remains hid in the persistent, calyx-tube; at its top and base I observe a beard of very curious, stiff, white bristles, less than a line in length, thicker in the middle, and tapering toward both extremities. The fruit seems to be somewhat persistent, as I find it in specimens collected in spring before the flowering-season. About the time of flowering, the young leaves begin to develop at the end of the branchlets, leaving the flowers between them and the leaves of the year before. I generally find 4 or 5 leaves of the same year's growth at the end of each branchlet; they probably fall off when about 15 or 18 months old.

This fine tree, discovered by Nuttall on Bear River, north of the Salt Lake, and near "Thornberg's Ravine" in the Rocky Mountains, was found by the expedition on the Lookout Mountains and other mountain-chains of the basin.

CACTACEÆ.

The geographical limits of the area of this curious American family have been considerably enlarged by this expedition, proving the presence of at least 7 species in the Utah Basin between the thirty-eighth and fortieth parallels, viz: 2 Echinocacti, 1 Cereus, and 4 Opuntiæ. Several species known before have been found in new localities, and 3 new and very distinct species have been discovered, 2 Echinocacti and 1 Opuntia.

MAMILLARIA VIVIPARA, *Haworth, Suppl. p.* 72; *Torrey & Gray, Fl. N. Am.* 2, *p.* 554; *Engelm. Synops. Cact. p.* 13; Cactus viviparus, *Nuttall, Gen.* 1, *p.* 295.

Was collected in the South Pass and on Sweetwater River. It extends from here to the mountains of Colorado and New Mexico, but its most characteristic forms are peculiar to the more elevated plains, where it assumes that cespitose, spreading appearance, from which it has received its name. The mountain form usually makes larger heads, but remains single or branches out very sparingly. Its large purple flowers, with numerous lance-linear, long acuminate, bristle-pointed petals, and its leather-brown pitted seeds, readily distinguish it from allied species.

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Echinocactus Simpsoni (*spec. nov.**) simplex, subglobosus seu depressus, basi turbinatus, mamilliferus; radicibus fasciculatis; tuberculis laxis ovatis apice oblique truncatis axilla nudis, junioribus leviter compressis basi deorsum productis, vetustioribus obcompressis basi dilatatis; areolis ovatis seu ovato-lanceolatis, nascentibus albovillosissimis mox nudatis; aculeis exterioribus sub 20 radiantibus tenuibus rigidis rectis albidis, additis supra aculeis 2–5 setaceis brevibus, interioribus 8–10 robustioribus obscuris erecto-patulis, areola florifera sub tuberculi apice arcolae aculeigerae contigua circulari; floribus in vertice dissitis minoribus; ovario abbreviato squamis sepaloideis triangulatis paucissimis (1–3) instructo; sepalis tubi brevis late infundibuliformis orbiculatis seu ovatis obtusis membranaceo-marginatis crenulatis fimbriatis, sepalis superioribus 10–12 ovatis obtusis integriusculis, petalis 12–13 oblongis apice crenulatis cuspidatis ex virescente roseis; stigmatibus 5–7 brevibus erectis, bacca parva viridi sicca umbilico latissimo truncata squamis paucis subinde aculeiferis instructa flore marcescente demum deciduo coronata irregulariter basi seu latere dehiscente; seminibus magnis obovatis obliquis minute tuberculatis, hilo magno ovato subbasilari, embryone circa albumen parcum fere circumvoluto hamato.

Var. *β* minor: tota planta, tuberculis, aculeis, floribus seminibusque minoribus.

Butte Valley in the Utah Desert, and Kobe Valley farther west; fl. in April and May, fr. in June and July. Var. *β* comes from the mountains of Colorado. This and the New Mexican *Echinocactus papyracanthus*,† the Mexican *Ech. horripilus*, Lem., and perhaps the South American *Ech. Odierii*, Lem., and *Ech. Cummingii*, Salm, and probably one or two others, form the small group of *Echinocacti*, with the appearance of *Mamillaria* (*Theloidei*, *tuberculis spiraliter dispositis distinctis*, Salm, Cact. Hort. Dyck 1849, cult. p. 34). They constitute the closest and most imperceptible transition to *Mamillaria* subgen. *Coryphantha*, Synops. Cact., p. 8, which bear the flowers in the axils of the nascent tubercules, the flower-bearing and the spine-bearing areolæ being connected by a woolly groove. In *M. macromeris*, Engelmann, they come from the middle of the tubercule (Cact. Mex. Boundary, t. 15, f. 4), and in the *Theloidei* they advance to the top of the tubercule close to the spines, thus assuming the position which the flowers regularly occupy in the genus *Echinocactus* (see Cact. Mex. Bound. t. 20, f. 2; t. 21; t. 25, f. 1; t. 27, f. 1; t. 28, f. 2).‡

The ovary is also almost naked, like that of *Mamillaria* generally, or has only a few scales, like that of *M. macromeris*. On the other hand, the dry fruit, such as is often found in *Echinocactus*, but never in *Mamillaria*, the tuberculated black seeds, and especially the large and curved embryo, and the presence of an albumen, do not permit a separation from *Echinocactus*.

This species is further interesting because it again strikingly proves that the

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* An extract of this description was published in the Transactions of the Saint Louis Academy of Sciences, vol. 2, p. 197 (1863).

† The plant I formerly described as *Mamillaria papyracantha*, Plant. Fendl., p. 49; Synops. Cact., p. 8, proves to belong to this section of *Echinocactus*. A closer examination of Mr. Fendler's original specimen shows that the floral areola joins the spiniferous one at the apex of the small nascent tubercules. Thus far Mr. Fendler's specimen, found near Santa Fé, has remained the only one ever obtained of this pretty species.

‡ *Echinocactus brevihamatus*, Engelm., forms an exception. In this species, the flowers are situated exactly as in *Coryphantha*, at the base of the tubercle, and connected with the distinct spiniferous areola by a woolly groove, (see Cact. Mex. Bound. t. 19, fs. 2 and 3).

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general appearance, the *habitus*, of a cactus plant, not necessarily indicates its real affinities. Not only is it a true *Echinocactus*, notwithstanding every appearance of a *Mamillaria*, but it is, moreover, closely allied in all its essential characters to the very compact *Ech. intertextus*, Engelm., C. Bound. p. 27, t. 34, in which all traces of tubercules are lost in the straight ribs. It has the same small flowers and the same small dry fruit, containing few large seeds, of similar structure, though not entirely the same arrangement of the spines.

Full-grown specimens of our plant are 3–5 inches high and 3–4 inches in diameter, of dark-green color; tubercules loosely arranged in $\frac{8}{21}$ or $\frac{13}{34}$ order, 8 and 13 spirals being most prominent. They are 6–8 lines long, at base somewhat quadrangular, 6–7 lines wide in the vertical and 4–5 lines in the transverse diameter, becoming subcylindric upward; areolæ 3–4 lines long, a little more than half as wide. The fruit-bearing tubercules are rather stouter and shorter. Exterior spines 4–6 lines long, whitish; interior ones spreading, stouter, and a little longer (5–7 lines long), yellowish and upward deep brown or black; no truly central spine. In the very young plant, the spines, 18–20 in number and only 1–$1\frac{1}{2}$ lines in length, are all radiating, closely fitting with their compressed bulbous bases on a linear areola, resembling in shape and arrangement those of *Cereus cæspitosus*. Soon afterward the areola becomes wider, and 6 or 8 short, stout, brown interior spines make their appearance, divergent like the original ones. Next the ordinary arrangement, as described above, takes place.

It seems that quite early in spring the young tubercules on the vertex of the plant begin to form, exhibiting their densely woolly tops, and soon afterward, long before any spines make their appearance, the tips of the smooth brown flower-buds come out. The flowers are 8–10 lines long and of nearly the same diameter, externally greenish-purple, petals yellowish-green or verging to pale purple. The short stamens arise from the whole surface of the tube, leaving only a very small nectariferous space in its base. The fruit is about 3 or $3\frac{1}{2}$ lines long and almost as wide, borne on a very large circular areola, surrounded by a woolly margin (see t. 2, f. 1). It bears toward its top 1–3 scales, sometimes with 1 or 2 small spines in their axils. The fruit usually opens by an irregular lateral slit; falling off, its base remains attached to the areola, as is the case in many (or all? or only all the dry-fruited?) *Echinocacti*, thus producing a basal opening (see t. 2, f. 5). Seeds $1\frac{1}{2}$ lines long in the longest diameter, covered with minute close-set tubercles. The young seedling shows erect, pointed cotyledons, and, when a few weeks old, begins to develop its pubescent spines.

Var. *β* has been received this fall from the Colorado gold-region;* the smallest specimens were 1 inch in diameter, globose, the small tubercules in $\frac{8}{21}$ order, spines $1\frac{1}{2}$–2 lines long, often curved; sometimes 1–3 darker stouter ones in the center. The larger specimens are almost of the size of those of Utah, but often depressed at top; tubercules arranged in $\frac{13}{34}$ or even $\frac{21}{54}$ order, spines only 4–5 lines long, 20–28 external and 6 or 7 internal ones.

This species has been named in honor of the gallant commander of the expedition.

* It here grows and thrives probably at a higher elevation than any other northern Cactus, occupying *e. g.* the gravelly moraines of the Glacial period of Clear Creek Valley, between 8,000 and 9,000 feet altitude, and in the southern part of the Territory, the Sangre de Cristo Pass, 10,000 feet high (January, 1876).

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Plate 1. *Echinocactus Simpsoni* as it appears in early spring; on the vertex a young growth of tubercules is visible, their tops covered with wool.

Plate 2. Details of the same.

Fig. 1. Four tubercules from near the vertex, one shows the broad scar where the fruit has fallen off, another one is just developing its spines, exhibiting their points above the thick wool.

Fig. 2. A detached tubercule bearing a ripe fruit.

Figs. 3 and 4. Flowers with the upper part of the tubercule and its young spines.

Figs. 5 and 6. The fruit magnified three times; fig. 5 showing the basal opening, fig. 6 the broad umbilicus.

Fig. 7. A scale of this fruit, more magnified, with two axillary spines.

Figs. 8–12. Seed: fig. 8 natural size, the others eight times magnified; fig. 9 lateral, fig. 10 dorsal, fig. 11 basal view; fig. 12 part of the surface, highly magnified.

Fig. 13. Embryo, enveloped in the inner seed-coat, including also the albumen; magnified.

Fig. 14. Lateral, fig. 15 frontal view of the embryo, magnified.

Fig. 16. Seedling, a few weeks old, magnified.

Fig. 17. Tubercules of the smaller variety from Colorado, in every state of development.

ECHINOCACTUS PUBISPINUS (*spec. nov.*)* parvulus, turbinatus, costis 13 subobliquis compressis interruptis tuberculatis; areolis orbiculatis, aculeis brevibus, rectis seu sæpe curvatis albidis, apice adustis velutinis demum nudatis; radialibus superioribus 1–2 robustioribus, longioribus rectis curvatis seu hamatis, ceteris 5–8 brevioribus; aculeo centrali deficiente seu singulo robustiore longiore arrecto sursum hamato; flore?; fructu?.

Pleasant Valley, near the Salt Lake Desert, found May 9 without flower or fruit. Plant 2 inches high, 1 or $1\frac{1}{4}$ in diameter; compressed tubercules 4–6 lines distant from one another, confluent in 13 ribs, radial spines 1–4 lines long, white pubescent or almost tomentose, more so than I have observed it in any other cactus; on the lower areolæ, I find only 5–6 spines, the upper ones a little longer and stouter than the balance; farther upward, the number increases to 10, one or more of the upper ones becoming still stouter and often hooked; at last here and there a single central spine makes its appearance, 5–6 lines long, the strong hook always turned inward or upward. At first, only the dusky point of the spine is naked; with age, the whole coating seems to wear off. In another specimen, I find the spines 8–12 in number, a little longer, more slender, all radiating. The small supraspinal areola proves this plant to be an *Echinocactus;* it probably belongs, together with the next, to the section *Hamati*, Synops. Cact. p. 15.

ECHINOCACTUS WHIPPLEI, *Engelm. & Bigelw, Pacif. R. Rep. IV, Cact. p.* 28, *t.* 1, *Syn. Cact. p.* 15. Var. SPINOSIOR: globosus; costis 13 compressis interruptis; aculeis radialibus 9–11, inferioribus sæpe obscurioribus, reliquis longioribus niveis, 2 superioribus sæpe

* This description has been published in Trans. Acad. St. Louis, vol. 2, p. 199 (1863). It is rather strange that neither this nor the above-mentioned *E. papyracanthus* has ever been found again (January, 1876).

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elongatis complanatis curvatis; centralibus 4, summo elongato complanato pergamentaceo flexuoso albo, 3 reliquis paullo brevioribus obscuris omnibus seu solum infimo hamatis; floribus minoribus; ovario squamis sepaloideis 5 oblongis munito; sepalis tubi linearibus margine membranaceis integris mucronulatis, petalis angustis oblongis; stigmatibus 6–7 brevibus in capitulum globosum congestis; bacca ovata parce squamata floris rudimentis persistentibus coronata.

The species was originally discovered on the Little Colorado by Dr. Bigelow, and was found afterward on the same stream by Dr. Newberry; the variety here described was met with more than 5 degrees farther north, in Desert Valley, west of Camp Floyd; remains of fruit, with the withered flowers attached, and some seeds, were found concealed between the spines from which the description has been drawn.* Globose heads 3 inches in diameter, radial spines $\frac{1}{2}$–$1\frac{1}{2}$ inches long, central ones $1\frac{1}{2}$–2 inches in length; flowers, if I may judge from the withered remains, about 1 inch long; ovary small, bearing about 5 membranaceous scales, the lower triangular, the upper oblong-linear, almost entire, and never cordate or auriculate at base, as they appear in most of the allied species; sepals of tube also narrow, linear, or oblong-linear, 2–5 or 6 lines long, $\frac{1}{2}$–1 line wide, stigmas about $\frac{1}{2}$ line long. Fruit apparently an oval berry, $\frac{1}{2}$ inch long; seed just as it is described and figured in Whipple's Cactaceæ; the tubercules on the seed-coat are extremely minute and distant from one another, each forming a central protuberance on the otherwise flat surface of an angular cell of two or three times the diameter of the tubercule itself; embryo curved about $\frac{3}{4}$ around a rather copious albumen.

CEREUS VIRIDIFLORUS, *Engelm. in Wisliz. Mem. note* 8, *sub Echinocereo; Cact. Mex. Bound. t.* 36; *Synops. Cact. p.* 22.

This is evidently the northernmost *Cereus*, extending to the Upper Platte; it is abundant in Colorado. These northern specimens are 1–3 inches high, 13-ribbed, and show the greatest variability in the color of the radial spines; in some bunches, they are all red, in others white, in others again the colors are distributed without much regularity; sometimes the upper and lower spines are white and the lateral ones red, or a few or even a single one above and below are red and all the rest white; or the lower ones are red and the upper ones white, and all these variations sometimes occur on the same specimen. I mention this to show how little reliance can be placed on the colors or the distribution of the colors of the spines. Central spines wanting or 1 or 2 projecting horizontally, straight or curved upward, white or tipped with purple or all purple, 6–9 lines in length.

CEREUS ENGELMANNI, *Parry in Sillim. Journ. n. ser.* 14, *p.* 338; *Engelm. Cact. Bound, p.* 36, *t.* 57; *Synops. Cact. p.* 27.

Deserts west of the Salt Lake, without flower or fruit. Specimen entirely similar to the one figured in the Cactaceæ of the Boundary. The species seems to extend from the Salt Lake region southwestwardly to Arizona and the Mohave country.

* The botanist of Dr. Hayden's Expedition of 1875, Mr. Brandegee, found it abundantly in Southwestern Colorado (January, 1876).

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OPUNTIA SPHÆROCARPA, *Engelm. and Bigelow, Pac. R. Rep. IV, Cact. p.* 47, *t.* 13, *fs.* 6–7; *Syn. Cact. p.* 44. Var.? UTAHENSIS: diffusa, læte-virens, articulis orbiculato-obovatis, crassis, junioribus sæpe globoso-obovatis; areolis subapproximatis; foliis minutis subulatis divaricatis; setis brevissimis paucis stramineis; aculeis nullis seu parvulis nunc singulo longiore recto robusto albido; floribus sulphureis, ovario obovato areolis fusco-tomentosis sub-25 instructo, sepalis exterioribus transversis obcordatis cuspidatis; petalis 8 late-obovatis emarginatis; stylo vix supra stamina exserto; stigmatibus 8 brevibus erectis; bacca obovata areolis plurimis tomentosis stipata; seminibus numerosis irregulariter compressis anguste marginatis.

Pass west of Steptoe Valley, in the western mountains of the Basin, found July 19 in flower and fruit. Joints 2–3 inches long and of almost the same diameter; often over $\frac{1}{2}$ inch in thickness, sometimes almost terete or rather egg-shaped; areolæ 6 or 8 lines apart; leaves very slender and acute, scarcely 1 line long, smaller than in any other of our species except *O. basilaris*, also a western form from the Lower Colorado. Bristles few, and even in old joints scarcely more than $\frac{1}{2}$ line long; spines none, or on the upper areolæ a few short ones, with here and there a stouter one $\frac{3}{4}$–1 inch in length. Flowers nearly 3 inches in diameter, pale or sulphur-yellow, when fading, reddish; fruit about 1 inch long and half as wide, with a deep umbilicus, and with 20–25 areolæ, which sometimes show a few bristles or a minute spine; seeds very irregular, 2, or, in the largest diameter, sometimes $2\frac{1}{2}$ lines wide.

Unwilling to increase the number of illy-defined species in this most difficult genus, I attach this plant to the only species known to me to which it possibly can be compared, *O. sphærocarpa* from New Mexico, though its fruit is not spherical, has not a shallow umbilicus, and is, at least in the specimen before me, not dry; the latter would be an insuperable distinction, if we might not suspect, what in fact is often the case, that the fruit later in the season would become dry and brittle. The leaves, which heretofore have been entirely too much neglected as a diagnostic character in this genus, and the flowers of the original *O. sphærocarpa*, are unknown thus far.

OPUNTIA TORTISPINA, *Engelm. & Bigelow, l. c. p.* 41, *t.* 8. *fs.* 2–3; *Syn. Cact. p.* 37.

Forks of the Platte; in flower in July. The specimens being very incomplete, I am not quite sure that this is the same species as that of Captain Whipple's Expedition; the joints appear to be somewhat smaller, the areolæ closer together, and the spines shorter (1–$1\frac{1}{2}$ inches) and rather weaker; it may possibly prove to be an extreme form of *O. Rafinesquii*, the area of which extends to the Rocky Mountains. Leaves subulate, 2 lines long; flowers $2\frac{1}{3}$–3 inches in diameter, sulphur-yellow; ovary long (1–$1\frac{1}{2}$ inches), with 20–30 areolæ, with light-brown wool and short bright-brown bristles; exterior sepals obovate, lance-cuspidate; petals 6–8, broadly obovate, obtuse, crenulate; stigmas 6–8, short, erect, as long as the stamens.

OPUNTIA HYSTRICINA, *Engelm. & Bigelow, l. c. p.* 44, *t.* 15, *fs.* 5–7; *Syn. Cact. p.* 43.

A flowering specimen, collected in June between Walker and Carson Rivers, is exactly like one found by Dr. Bigelow on the Colorado Chiquito; it has slenderer and straighter spines than the one figured in Whipple's Report, and approaches somewhat to *O. erinacea*, E. & B., of the Mohave region, in which I now recognize the long-los:

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O. rutila, Nutt. in Torr. & Gray Flor. 1, p. 555. Joints 5 inches long, half as wide, obovate; leaves 1½ lines long; areolæ closely set with long straw-colored bristles; lower ones with few and short white spines, upper ones with numerous grayish-red spines, 1½–2 inches in length. Flowers pale straw-colored, 2½–3 in diameter; ovary 1 inch long, with 20–30 white woolly aculeolate areolæ; exterior sepals oblanceolate, squarrose, or recurved at the elongated tip; petals obovate, obtuse, crenulate; style with 8 or 10 short erect stigmas, longer than the stamens. The squarrose tips of the sepals are particularly conspicuous on the bud.

Opuntia Missouriensis, *De Cand. Prod.* 3, *p.* 472; *Torr. & Gray, Fl.* 1, *p.* 555 (*in part*); Cactus ferox, *Nutt. Gen.* 1, *p.* 296.

From the deserts of Salt Lake Valley to Rush Valley; specimens without flower or fruit. Joints small (2–3 inches long), broadly obovate or circular; areolæ closely set; spines numerous, stiff, stout, angular, white, mostly deflexed.

Opuntia Missouriensis, var. albispina, *Engelm. & Bigelow, l. c. p.* 46; *t.* 14, *fs.* 8–10; *Syn. Cact. p.* 44.

Smith Creek, Lookout Mountains, in Western Utah; flowering in July. By their slender flexuous spines, the specimens approach to var. *trichophora.* Flowers 3–3½ inches in diameter, bright golden-yellow; ovary 1 inch long, with 20 or 25 areolæ, scarcely spiny; exterior sepals obovate, cuspidate; petals about 8, obtuse, crenulate; style shorter than the stamens; stigmas about 5, very short, erect. Some flowers have elongated and very spiny ovaries, evidently abortive.

Opuntia fragilis, *Haworth, Suppl. p.* 82; *Torr. & Gray, Fl.* 1, *p.* 555; *Synops. Cact. p.* 45; Cactus fragilis, *Nutt. Gen.* 1, *p.* 296.

Fort Kearny to the North Platte country; in flower in June and July. This is, I believe, the first time that the flowers of this species were collected since Nuttall's discovery of it in 1813. Travelers report that the plant is very frequently seen in the sterile prairies east of the Rocky Mountains, but that it is rare to find them in flower and rarer still in fruit. Since many years I have the plant in cultivation from specimens brought down by Dr. Hayden, but have not been able to get it to flower. Nuttall only informs us that the flowers are solitary and small. In the specimen before me, they are yellow, scarcely 2 inches in diameter; ovary 8–9 lines long; the 13–15 areolæ are densely covered with thick white wool; the upper ones bear a few white spines; lower sepals broadly oval, with a short cusp; petals 5, obovate, rounded, crenulate; style longer than the stamens; stigmas 5, short, erect, cuspidate.*

* Through the kindness of Dr. A. W. Chapman, of Apalachicola, Fla., I have received living specimens and fruit of *O. Pes Corvi*, so that I can now complete the description of this very distinct southern species.

Opuntia Pes Corvi, *Le Conte in herb. Engelm.*; *Append. to Synops. Cact. in Proceed. Am. Acad. Arts & Sc.* 3, *p.* 346; *Chapman, Fl. South. U. S. p.* 145: diffusa, læte viridis; articulis parvis ovatis seu obovatis tumidis sæpius teretiusculis concatenatis fragilibus; pulvillis subdistantibus pulvinatis; foliis teretiusculis ovatis cuspidatis incurvis; areolis junioribus albo-tomentosis setas parcas brevissimas pallidas et plerisque aculeos 1–3 rectos rigidos sæpe basi compressos tortosve obscuros gerentibus, infimis inermibus; floribus flavis minoribus; ovario obovato pulvillos perpaucos fusco-villosos gerente; sepalis exterioribus ovato-lanceolatis, interioribus obovatis cuspidatis; petalis sub-5 obovatis spatulatis obtusis; stylo stamina æquante, stigmatibus 4–5 erectis; seminibus paucissimis anguste obtuseque marginatis in pulpa viscosa baccæ parvæ rubræ sæpe floris rudimentis coronatæ nidulantibus.

Barren sandy places along the coast of Georgia and Florida. Joints 1–3 inches long, obovate tumid, or narrower

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OPUNTIA PULCHELLA (*spec. nov.*) :* parvula cæspitosa diffusa; articulis parvis obovato-clavatis; foliis minutis e basi ovata subulatis; areolis confertis, superioribus aculeos albidos rectos, singulum longiorem complanatum porrectum seu deflexum alios brevissimos radiantes gerentibus; floris purpurei ovario areolis 13–15 convexis albo villosissimis et longe setosis dense stipato; sepalis inferioribus lineari-oblongis breviter cuspidatis, superioribus spatulatis; petalis sub-8 obovatis obtusis, stylo cylindrico exserto, stigmatibus 5 linearibus suberectis; bacca sicca setosissima, seminibus crassis rhaphe lata plana notatis.

Sandy deserts on Walker River;† fl. in June.

This is one of the smallest, as it is one of the prettiest, species of this genus. It belongs to the small section of *Clavatæ* (Synops. Cact. p. 46) of the cylindric *Opuntiæ*, but is distinct from all those known to me by its small joints and purple flowers; all the others have, so far as I know, yellow flowers. Joints 1–1¼ inches long, 4–6 lines thick, very slightly tuberculated; leaves scarcely one line long; areolæ crowded, white woolly; larger central spine on the upper areolæ 4–6 lines long, flat, and somewhat rough above, convex below; smaller ones 4–6 or 10, radiating, ½–1½ lines long; flowers crowded, of a beautiful bright purplish-red or deep rose-red color, 1¼–1½ inches in diameter; ovary 4–5 lines long, beset with white capillary spines, 3–5 lines long, 15–20 on each areola; style not ventricose, as is usual in the genus, but cylindric; stigmas slender, pale yellow; berry clavate, at last dry, about 1 inch long, well marked by the conspicuous white-woolly areolæ and their numerous purplish-brown, flexible, hair-like bristles, 4–6 or 7 lines long. These bristles are entirely destitute of the minute barbs which otherwise invariably characterize spines and bristles of *Opuntiæ*. The thick round seeds, 2 lines in diameter, are well distinguished by a broad rhaphe, much wider than I have seen it in any other clavate *Opuntia*.

Plate 3, Fig. 1. Part of a plant of *Opuntia pulchella*, showing a flower-bud and two flowers, natural size.

Figs. 2–4. Bunches of spines, 4 times the natural size.

Fig. 5. Section of a larger spine, more magnified.

Fig. 6. A leaf from an ovary with the axillary woolly and bristly areola, 4 times natural size.

Fig. 7. A fruit.

Figs. 8–9. Seed, 4 times magnified; fig. 9 showing the broad rhaphe.

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and cylindric, fresh or dark green, usually growing one on top of the other, forming chains of 1 or 2 feet long, at last prostrate; joints fragile, separating as readily as in *O. fragilis;* tumid pulvilli 4–6 or even 8 lines apart; leaves 2½–3½ or 4 lines long, incurved; spines 1–1½ inches long, very straight, when in threes divergent like the "crowsfoot" used against cavalry, whence the name given by the military gentlemen who discovered this species. Flowers 1½–1¾ inches in diameter; sepals and petals less numerous and narrower than in any allied species; ovary about ½ inch long, with only 2 or 3 areolæ on the surface and 3–5 on the upper margin. Fruit obovate, 6–7 lines long, rose-purple, with a shallow umbilicus, oftened crowned with the blackened remains of the flower; areolæ almost obliterated; red pulp very glutinous, including 1–3 or at most 5 seeds, which are regularly shaped, lenticular, with a narrow but thick and very obtuse rim. By its pulpy fruit, this species is widely removed from *O. fragilis*, to which its tumid and fragile joints seem to ally it, nor can it be confounded with any other species, though allied to *O. vulgaris* and *O. Rafinesquii.*

* An account of this species was given in the Transactions of the St. Louis Acad. 2, p. 201 (1863).

† This pretty species was afterward collected, 1867, "among the sage brushes" of Nevada, by Mr. William Gabb and in the following year by Mr. S. Watson "frequent in the valleys of Western Nevada from the Trinity Mountains to Monitor Valley, 4–5,000 feet alt."

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COMPOSITÆ.

The name of "*Wild Sage*", now so familiar to every traveller in our western mountain-deserts, was first used by Lewis and Clarke, in the narrative of their adventurous expedition, to designate several species of *Artemisia* or *Wormwood*, distantly resembling the true garden sage, *Salvia officinalis*, by their gray foliage and aromatic odor. It seems that now this name has, by common use, been restricted to the larger shrubby species, which give a peculiar character to the arid plateaus of Western North America, and which are of the highest importance to the traveller as "furnishing the sole article of fuel or shelter which they meet in wandering over these woodless deserts", as already Nuttall informs us in his genera of North American Plants, 2, p. 142. He states that the "Wild Sage" is his *Artemisia Columbiensis*, which name was by him improperly substituted for the prior name of *A. cana*, described by Pursh from the original specimens of Lewis and Clarke. Torrey and Gray, in their Flora of N. America, 2, p. 418, doubt whether this really is the "Wild Sage" of those travelers, and come to the conclusion that that name was indiscriminately applied to several shrubby species; they further state that the plant given by Governor Lewis to Pursh as "the Sage" is the herbaceous *A. Ludoviciana* found on the homeward voyage on the Missouri River.

I have now the means, through information obtained from Mr. H. Engelmann and from Dr. F. V. Hayden, to throw a little more light on this question, which is not without importance for botanical geography. The two species here in question are—

ARTEMISIA CANA, *Pursh, Fl. Am. sept.* 2, *p.* 521; *Torrey and Gray, Fl. N. Am.* 2, *p.* 418.—Shrubby, with woody stem 2–4 inches in diameter, 2–4 feet (on the Yellowstone, Dr. Hayden) or 2–6 feet high (on the Laramie Plains, H. Engelmann). Stem covered with a light-gray bark, which is separated into many layers of loose shreds connected by smaller transverse fibers, and is readily torn off. Wood light, porous, pale-colored, with very many darker brown medullary rays, easily separating along the division of the annual rings. These rings, or layers, are from $\frac{1}{2}$–1 line in thickness, as stems of $1\frac{1}{2}$–2 inches diameter show about a dozen rings, and are consequently as many years old. The stems are rarely cylindrical, but mostly compressed, knotty, and variously twisted, and often stunted; they are sometimes divided from the base, but oftener bear short and thick branches higher up. The annual branchlets are crowded along the older branches, 8–12 inches long, densely coated with a soft, white pubescence, and crowded with silvery-gray leaves, and bear toward their upper part and on the numerous short and erect lateral branchlets a profusion of small flower-heads, forming a spiked or contracted panicle, interspersed with short leaves. The leaves are flat, linear-lanceolate, entire or (the lower ones) rarely lobed, 1–2 or $2\frac{1}{2}$ lines wide and $1\frac{1}{2}$–2 inches long, the upper ones becoming smaller. The flower-heads are mostly sessile, or nearly so, hemispherical, about 2 lines long and wide; outer scales of involucrum shorter, foliaceous, and canescent (sometimes the lowest ones larger than the flowers, and pointed); inner scales nearly as long as flowers, brownish, scarious, obtuse, cottony-fimbriate on the margins. The flowers are all perfect, usually 5, in some specimens as many as 8 in number, $1\frac{1}{2}$ lines long; ovary glandular, and, when bruised, with the odor of wormwood.

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This is the "Wild Sage" of the Upper Missouri (above the mouth of the Yellowstone) and the Yellowstone River, and of the Laramie Plains, but it does not seem to occur west of the Rocky Mountains, as Torrey and Gray (*l. c.*) already state, and Nuttall (*l. c.*) must have confounded it with other species, when he contends that it is "still more abundant on the barren plains of the Columbia River", and that it grows 6 to 8 or 12 feet high.

ARTEMISIA TRIDENTATA, *Nuttall in Trans. Amer. Phil. Soc.* (*n. ser.*) 7, *p.* 398; *Torrey and Gray, Fl.* 2, *p.* 418.—Trunk, bark, and wood very similar to that of the last species, but trunk often larger, and usually even more twisted and knotty, with very numerous short and stunted branches, which are repeatedly divided into a great many smaller branchlets; ultimate annual branchlets fascicled, erect, only 3–6 inches long, canescent or silvery, very leafy at base, rather naked upward, bearing strict, rather compact, paniculate spikes, composed of sessile or usually pedunculate spikelets or glomerules of 3 to 6 or 8 sessile heads. Leaves silvery-white on both surfaces, crowded at the base of the branches, and often fascicled on short or stunted sterile branches, narrowly wedge-shaped, 1½–2 lines wide at the obtuse tridentate or trilobed end, narrowed down into a more or less distinct petiole; usually 3–6, rarely 8, lines long. Inflorescence interspersed with short and narrow, undivided, cuneate or spatulate obtuse leaves. Heads of flowers narrow, obovoid, nearly 1½ lines long, not much more than half as wide, with short and obtuse, canescent, exterior scales, and longer, scarious, interior scales, ciliate on the sides. Flowers in some specimens 3, in others often 4–5 in each head, all perfect, scarcely more than 1 line long; ovary quite glandular and with the odor of turpentine.

This is the "Wild Sage" of Utah, and, perhaps, of the whole region west of the Rocky Mountains, where it seems to supplant the more eastern *A. cana.* Nuttall, who first described it, calls it a shrub about a foot high, and as such it appears in the mountains of Colorado; but in Utah it is the largest and most abundant species, usually 2–4 feet high, rarely attaining a height of 6 feet, and then not straight, and with trunks of 3–6 inches diameter; sometimes the smallest bushes have trunks fully as thick as the tallest ones, short and chunky. East of the mountains, in the range of *A. cana*, it ever remains an inconspicuous shrub, lost among the more common species. Near Camp Floyd, specimens were collected bearing white tomentose excrescences of the size of a pea, or larger, undoubtedly galls caused by the sting of insects; the same have been observed on this species in Colorado.

The other species of *Artemisia* collected by the expedition were *A. Canadensis*, Michx., at Bridger's Pass; *A. Ludoviciana*, Nutt., at Sweetwater, Bridger's Pass, Round Prairie, etc.; *A. dracunculoides*, Pursh, on the Sweetwater; and *A. frigida*, Willd., on the Upper Sweetwater River.

CHENOPODIACEÆ.

SARCOBATUS VERMICULATUS, *Torrey in Emory's Report* (1848), *p.* 149. Batis (?) vermiculata, *Hooker, Flor. Bor.-Am.* 2, *p.* 128 (1840); Sarcobatus Maximiliani, *Nees in Pr. Maximil. Trav. Engl. ed. p.* 518 (*ex Torrey*), *Seubert in Bot. Zeitung*, 1844, *p.* 753, *cum tab., Lindley in Hooker, Lond. Journ. Bot. IV, p.* 1 (1845); Fremontia vermicularis,

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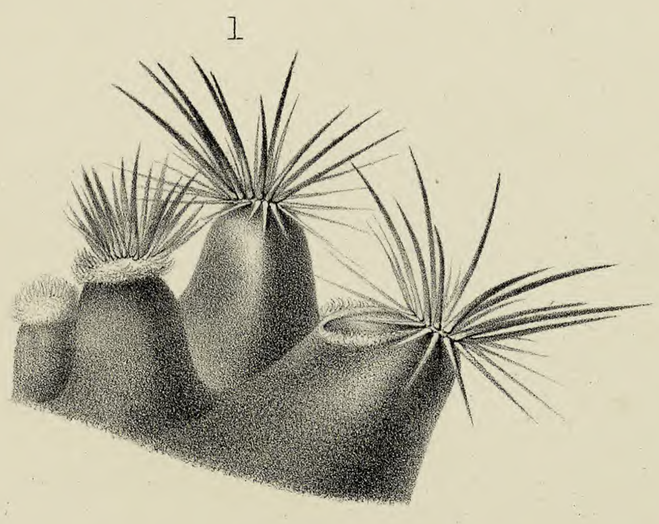


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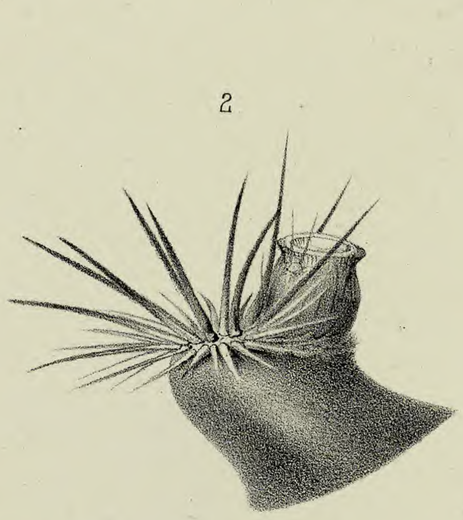
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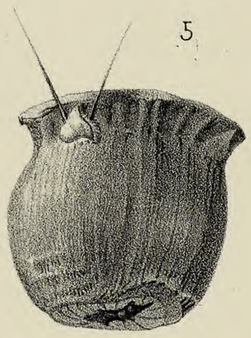
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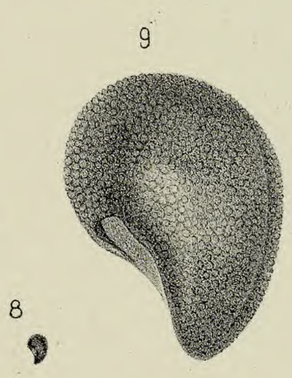

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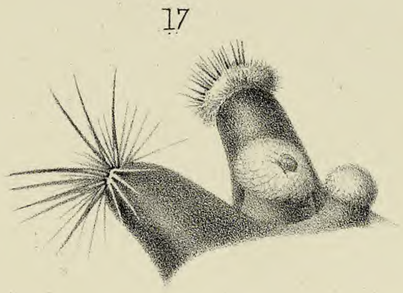

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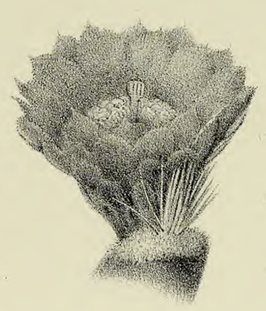

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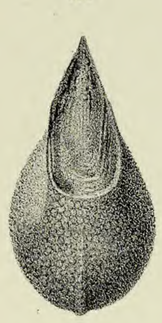

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